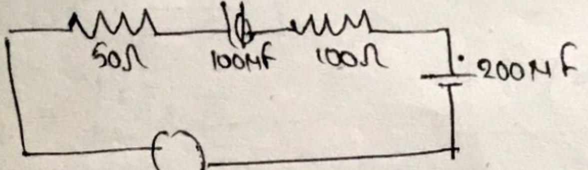
P) Practice Problems:-

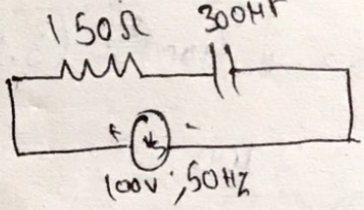
i)



100V ; 50Hz

1 μF = 10^{-6}

mH = 10^{-3}



$V_S = 100V$; $F = 50Hz$

$R = 150\Omega$; C = 300μF

$\omega = 2\pi f = 2\pi \times 50 = 100 \times \pi$
$= 628.318$

$X_c = \frac{1}{\omega C}$
$= 2\pi f C = -628.318 \times 300 \times 10^{-6}$
$= 0.18849.$

$Z = (R + J\frac{1}{\omega L}) = (R - JX_c)$
$= (150 - J\ 0.18849)$
$= \sqrt{(150)^2 - (0.18849)^2}$

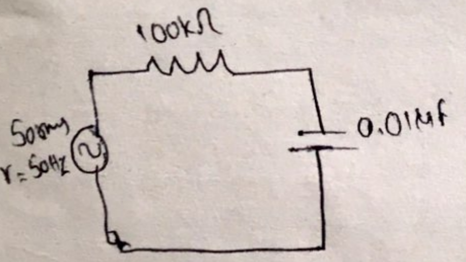
$Z = 150.0$

$I = \cancel{\frac{V_S}{Z}} = \cancel{\frac{100}{150}}$

Phase angle $\theta = \tan^{-1}\left(\frac{-0.18849}{150}\right) = \angle -0.071$

$I = \frac{V_S}{Z} = \frac{100\angle 0^\circ}{150\angle -0.071} = 1.5\angle 0.071^\circ.$

P)

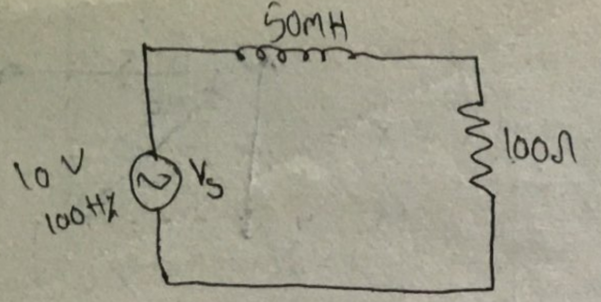


V = 50 ; F = 50Hz ; R = 100kΩ
$R = 100 \times 10^3 = 0.1$

C = 0.01 μF
$= 0.01 \times 10^{-6}$
$= 1 \times 10^{-8}.$

$X_c = \frac{1}{\omega C} = -J\omega C$
$= -2\pi f C = -2\pi \times 50 \times 1 \times 10^{-8} = -3.16 \times 10^{-6}$

2)



$V_S = 10V$; $F = 100Hz$; $L = 50mH$ $\quad R = 100\Omega$

$= 50\times10^{-3}$

$X_L = \omega L$

$= 2\pi f L = 2\times\pi\times100\times50\times10^{-3}$

$= 31.415\Omega$.

$Z = (R + J\omega L)$

$= (100 + J\ 31.415)$

$Z = \sqrt{(100)^2 + (31.415)^2}$

$Z = 104.818$

$\theta = \tan^{-1}\left(\frac{31.415}{100}\right) = 17.440$

$I = \frac{V_S}{Z} = \frac{10\angle 0^\circ}{104.818\angle 17.4^\circ} = 0.095\angle -17.4^\circ$

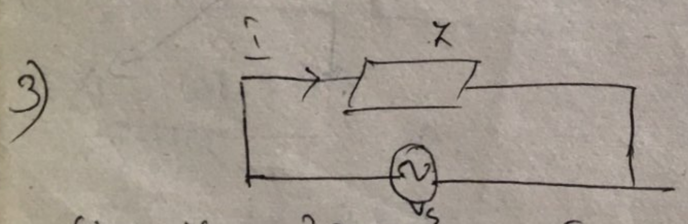
voltage across resistance $V_R = I R$

$= 0.095\times100 = 9.5V$

voltage across inductor $V_L = I X_L$

$= 0.095\times 31.415 = 2.997$.

3)

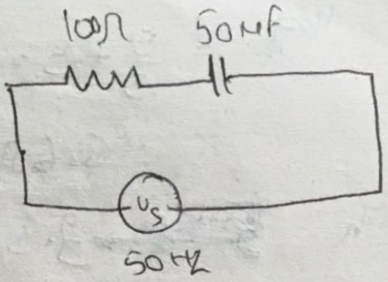


Given $V_S = 30 + J50$; $I = -5 + J15$

$Z = \frac{V_S}{I} = \frac{30 + J50}{-5 + J15}$

4)

$X_C = \frac{1}{2\pi f C}$



$X_C = \frac{1}{2\pi \times 50 \times 50\times10^{-6}}$

$= 0.015\Omega$

$Z = (R \mp jX_C)$

$= (100 - j\times 0.015)$

$= \sqrt{(100)^2 - (0.015)^2}$

$= 99.9$

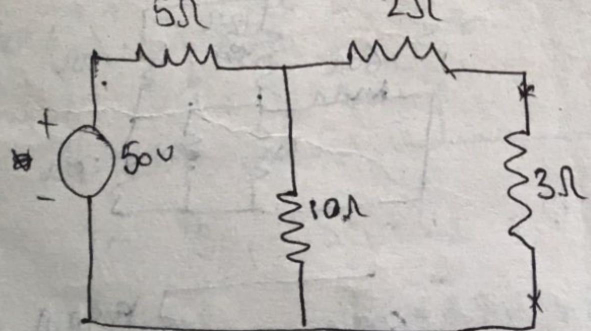
$\theta = \tan^{-1}\left(\frac{0.015}{100}\right) = 0.085$

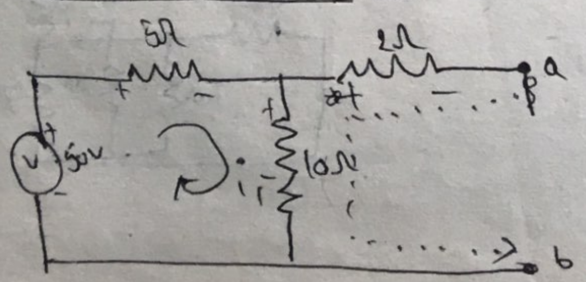
$I = \frac{V_S}{Z} = \frac{\sqrt{V_R^2 + V_C^2}}{Z} \Rightarrow$

Voltage at Resistor :- $V_R = I \times R$

$=$

Thevenin :-





$50 - 5i_1 - 10i_1 + 10i_2 = 0$

$50 - 15i_1 = 0$

$50 = 15i_1$

$i_1 = \frac{50}{15} = \frac{10}{3} = 3.33$

$i = 3.33$

$V_{th} = i \times 10$

$= 3.33 \times 10$

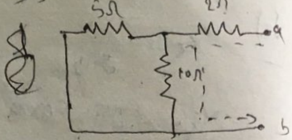
$= 33.3V$

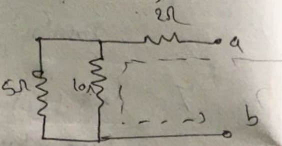
$R_{eq} = \cancel{\frac{5}{3} + 5} = \frac{20}{3}$

$= \cancel{6}.6\Omega$

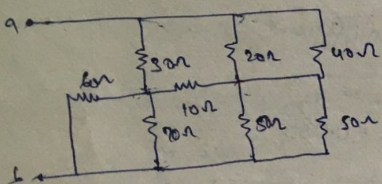
$R_{th} = 3.3 + 2$

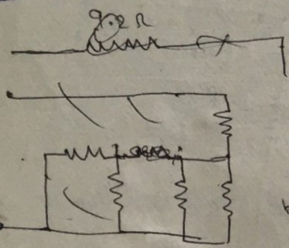
$= 5.33$

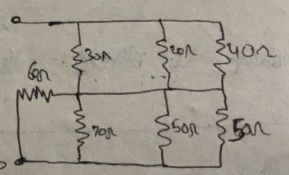


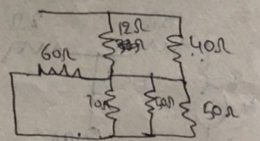


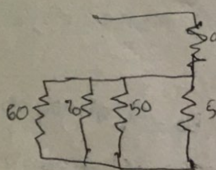
p)

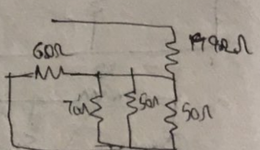


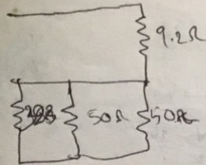


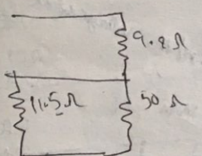


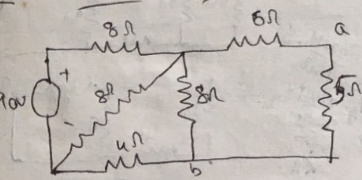


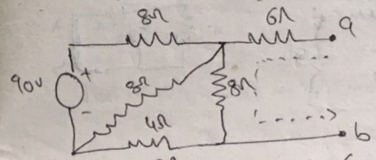


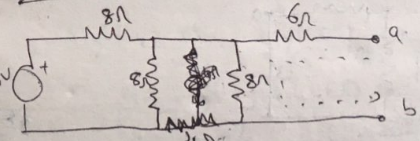


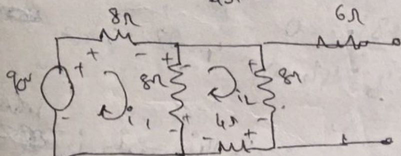








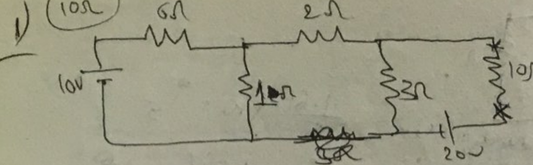


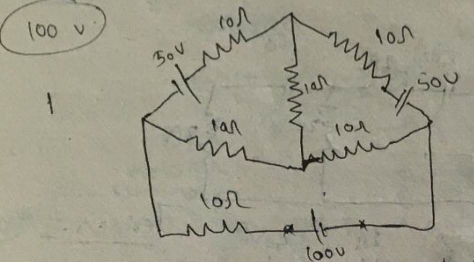


$90 - 8i_1 - 8i_1 + 8i_2 = 0 \Rightarrow 90 = 16i_1 - 8i_2$

$-8i_2 - 4i_2 - 8i_2 + 8i_1 = 0 \Rightarrow -20i_2 + 8i_1 = 0$

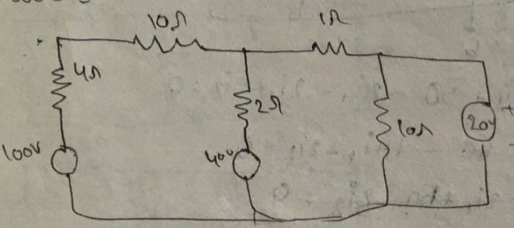
$i_1 = -22.5$; $i_2 = 2.81$

1) 

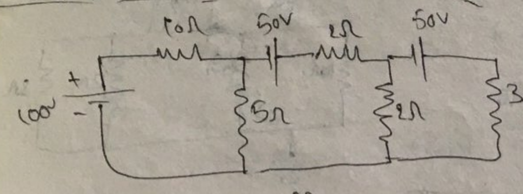
4) 

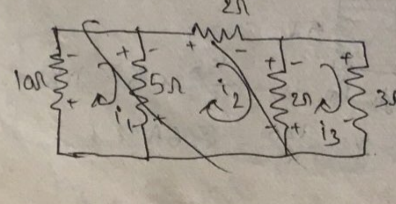
Determined current supplied through 100V

5) current across 4Ω



Nortons Th:-dol 2nd circuit:-





$-10i_1 - 5i_1 + 5i_2 = 0 \Rightarrow -15i_1 + 5i_2 = 10 \rightarrow$ (a)

$-2i_2 - 2i_1 + 2i_3 - 5i_2 + 5i_1 = 0 \Rightarrow -9i_2 + 2i_3 = 0 \rightarrow$ (b)

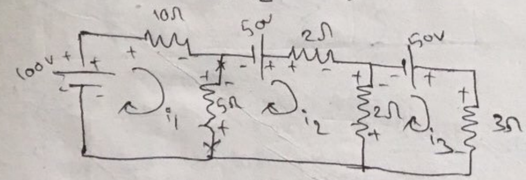
$-2i_3 + 2i_2 - 3i_3 = 0 \Rightarrow -5i_3 + 2i_2 = 0 \rightarrow$ (c)

$\Rightarrow$ Solving (b) and (c).

~~$-15i_1 + 5i_2 = 0$~~

$-9i_2 + 2i_3 = 0 \Rightarrow 2i_3 = 9i_2$

$2i_2 - 5i_3 = 0 \Rightarrow 2i_2 = 5i_3$.



$100 - 10i_1 - 5i_1 + 5i_2 = 0$

$-5i_2 + 5i_1 + 50 - 2i_2 - 2i_2 + 2i_3 = 0$

$-2i_3 + 2i_2 + 50 - 3i_3 = 0$

$100 - 15i_1 + 5i_2 = 0$.

$\Rightarrow -9i_2 + 5i_1 + 2i_3 + 50 = 0$

$\Rightarrow -5i_3 + 2i_2 + 50 = 0$

$\Rightarrow -15i_1 + 5i_2 + 100 = 0 \rightarrow$ (a)

$-9i_2 + 5i_1 + 2i_3 + 50 = 0 \rightarrow$ (b)

$\Rightarrow -5i_3 + 2i_2 + 50 = 0$

from (a) and (b)

* $i_1 = -10.4$; $i_2 = -11.36 + 2i_3$

$i_2 = -10.4$

$-5i_3 + 2(-11.3 + 2i_3) + 50 = 0$

$-5i_3 - 22.6 + 4i_3 + 50 = 0$

$i_3 - 22.6 + 50 = 0$

$i_3 = -27.4$

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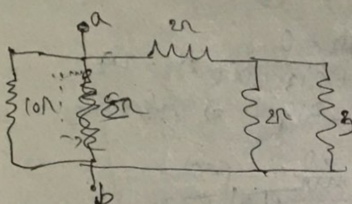
now:- $i_2 = -11.3 - 2\times27.4$

$= -11.3 - 54.8$

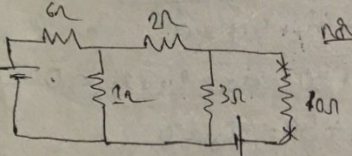
$i_2 = 66.1A$

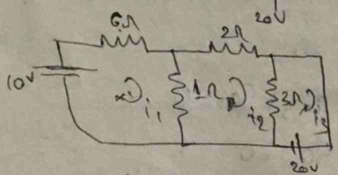
∴ $i_1 = -10.4A$; $i_2 = 66.1A$



$R_{Th} =$

3) Norton Th





$+10i_1 - 6i_1 - i_1 + i_2 = 0 \Rightarrow 3i_1 + i_2 = 0 \Rightarrow i_2 = -3i_1$

$-i_2 + i_1 - 2i_2 - 3i_2 + 3i_3 = 0 \Rightarrow -6i_2 + i_1 + 3i_3 = 0$

$\Rightarrow -6(-3i_1) + i_1 + 3i_3 = 0$

$19i_1 + 3i_3 = 0$

$-20 - 3i_3 = 0$

$-3i_3 = 20 \Rightarrow i_3 = -\frac{20}{3} = 6.6A$

$i_3 = 6.6$

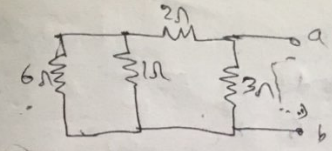
now:- $19i_1 + 3\times66 = 0$

$19i_1 = -20$

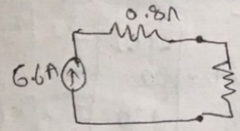
$i_1 = \frac{-20}{19} = 1.05$

$i_2 = -3\times1.05 = 3.15A$

$i_1 = 1.05A$; $i_2 = 3.15A$; $i_3 = 6.6$



R_{Th} :- $= 0.8\Omega$



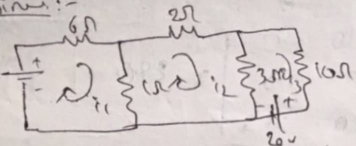
$V_{10} = IR$

$= 6.6\times10 = 66V$

current at 10Ω is $\frac{6.6}{10.8}\times 0.8$

$i_{10} = 0.4A$.

Thevenin:-



$+10 - 6i_1 - i_1 + i_2 = 0 \Rightarrow -7i_1 + i_2 + 10 = 0 \to (a)$

$-i_2 + i_1 - 2i_2 - 3i_2 + 3i_3 = 0 \Rightarrow -6i_2 + i_1 + 3i_3 = 0 \to (b)$

$-3i_3 + 3i_2 - 10i_3 - 20 = 0 \Rightarrow 3i_2 - 13i_3 - 20 = 0 \to (c)$

$\Rightarrow i_2 = 7i_1 - 10$

$\Rightarrow -6(7i_1 - 10) + i_1 + 3i_3 = 0$

$-42i_1 + 60 + i_1 + 3i_3 = 0$

$-41i_1 + 3i_3 = -60$

$3i_3 = -60 + 41i_1$

$i_3 = -\frac{60 + 41i_1}{3}$

$-3i_2 \cancel{-13i_3 - 20 = 0}$

$-6i_2 + i_1 + 3\times\left(\frac{-60+41i_1}{3}\right)$

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$-6i_2 + 42i_1 - 60 = 0$

$i_1 \quad i_2 \quad c$

$-7 \quad 10 \quad 1 \quad -7$

$42 \quad -60 \quad -6 \quad 42$

$$A = \begin{bmatrix} -7 & 1 & 0 \\ 1 & -6 & 3 \\ 0 & 3 & -13 \end{bmatrix} ; \quad B = \begin{bmatrix} -10 \\ 0 \\ +20 \end{bmatrix}$$

$\Delta = |A| = -470$

$$\Delta_1 = \begin{vmatrix} -10 & 1 & 0 \\ 0 & -6 & 3 \\ 20 & 3 & -13 \end{vmatrix} = -630$$

$$\Delta_2 = \begin{vmatrix} -7 & -10 & 0 \\ 1 & 0 & 3 \\ 0 & 20 & -13 \end{vmatrix} = 290$$

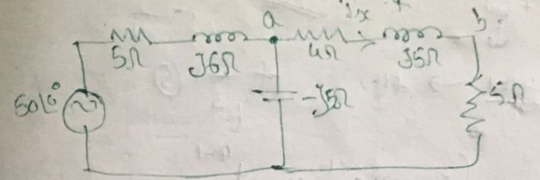
$$\Delta_3 = \begin{vmatrix} -7 & 1 & -10 \\ 1 & -6 & 0 \\ 0 & 3 & 20 \end{vmatrix} = 790$$

$i_1 = \frac{\Delta_1}{\Delta} = \frac{-630}{-470} = 1.340A$; $i_2 = \frac{\Delta_2}{\Delta} = \frac{290}{-470} = -0.61A$

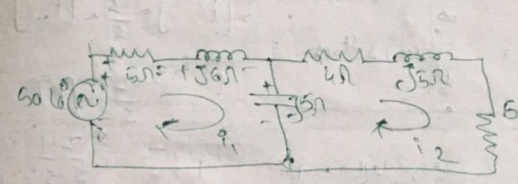
$i_3 = \frac{\Delta_3}{\Delta} = 1.68A$

7-Chapter

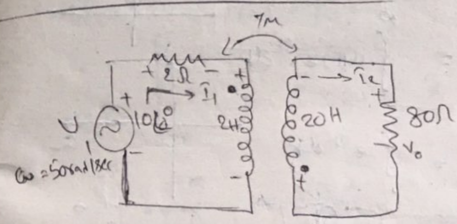
1)



$Z = 4 + J5$ b/w node a and b



$50\angle 0° - J5i_1 - J6i_1 + J5i_1 -$



$10\angle 0° - 2i_1 - 2\frac{di_1}{dt} + 2\frac{di_2}{dt} + 7\cdot\frac{di_2}{dt} = 0$

$-20\frac{di_2}{dt} + 20\frac{di_1}{dt} - 80i_2 + 7\frac{di_1}{dt} = 0$

$\Rightarrow$

$L[f(t)] \rightarrow F(s)$

Cos at

$f(t)\, u(t) \rightarrow f(t)$

$t \rightarrow (s)$

t^3

$L[f(t)] = \int_0^\infty f(t)u(t) e^{-st}\, dt$

t^{4-1}

$= \int_0^\infty f(t) e^{-st}\, dt$

$L[t^{4-1}] = \frac{3}{s} L[t^2]$

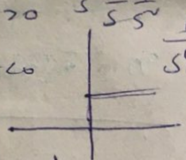
$t^{3-1} = \frac{2}{s} L[t]$

$= \frac{3}{s}\frac{2}{s}\frac{1}{s^2}$

$\frac{6}{s^4}$

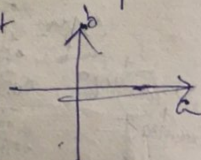
$f(t)$ $\quad f(t)\; u(t) = 1 \quad t>0$

$= 0 \quad t<0$



$L[u(t)] = \int_0^\infty u(t) e^{-st}\, dt$

$= \int_0^\infty e^{-st}\, dt$



$\cos \omega t = \frac{e^{j\omega t} + e^{-j\omega t}}{2}$

$= \left[\frac{e^{-st}}{-s}\right]_0^\infty = \frac{1}{\infty} + \frac{e^{-0}}{-s} = \frac{1}{s}$

e^{at}

$L[e^{at}] = \int_0^\infty e^{at} e^{-st}\, dt$

$s = a + bj$

$\int_0^\infty e^{-(a-s)t}\, dt$

$\left[\frac{e^{-(a+s)}}{-(a+s)}\right]_0 = \frac{1}{\infty} + \frac{e^{-0}}{(a+s)}$

$t^3 = \frac{3!}{s^4} = \frac{6}{s^4}$

$f(t) = \cos \omega t$

$\cos \omega t = \frac{e^{j\omega t} + e^{-j\omega t}}{2}$ $\quad t^n f(t) \quad f_1(t) f_2(t)$

$= \int_0^\infty \left(\frac{e^{j\omega t} + e^{-j\omega t}}{2}\right) e^{-st}\, dt$

$L[t^{n-1}] = \frac{n-1}{s} L(t^{n-2})$

$e^{-a(t-b)}$

$e^{at} \sin bt$

$\frac{b}{s^2+\omega^2}$

$(s+a)^2$

$\int_0^\infty \left[\frac{e^{-(s-j\omega)t}\, dt + e^{-(s+j\omega)t}\, dt}{2}\right] dt$

$t - a$

$\frac{1}{a}$

$\frac{1}{2}\left[\frac{e^{-(s-j\omega)t}}{-(s-j\omega)}\right]_0^\infty + \frac{1}{2}\left[\frac{e^{-(s+j\omega)t}}{-(s+j\omega)}\right]_0^\infty$

$L[f'(t)] = s F(s) - f(0)$

$\frac{s}{a}$

$\frac{1}{2}\left[\frac{1}{s-j\omega} + \frac{1}{s+j\omega}\right] = \frac{1}{2}\left[\frac{s+j\omega + s - j\omega}{s^2+\omega^2}\right]$

$\frac{j\omega}{s^2+\omega^2}$

ILATE

$\int u v\, d$

$u \int v - \int v\, du$

$\frac{1}{a}\left[\frac{s/a}{s^2+\omega^2}\right]$

$\cancel{\left[\frac{t^n e^{-st}}{-s}\right]_0^\infty} - \int e^{-st}\, n t^{n-1}\, dt$

$t^n \frac{e^{-st}}{-s} - \int_0^\infty \frac{e^{-st}}{s} n t^{n-1}\, dt$

$\left[t^n \frac{e^{-st}}{-s}\right]_0$

$u \int v - \int \int v\, du\, dt$

$\frac{t^n}{-s} + \frac{n}{s} L(t^{n-1}) \int_0^\infty e^{-st}\, t^{(n-1)}\, dt$

$\frac{n}{s} L[t^{(n-1)}]$

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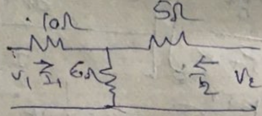
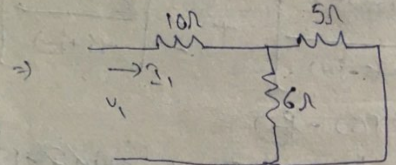
$[a f(t)] = a\, L[f(t)]$ $\quad L[f(t)+g(t)] = L f$

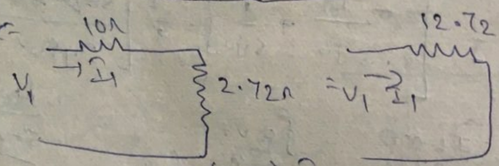
$L\left[\frac{d}{dt}[f(t)]\right]$

1) h – Parameters

$h_{11} = \frac{V_1}{I_1}\Big|_{V_2=0}$





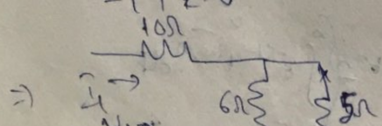


$V_1 = (12.72)\, I_1$

$\frac{V_1}{I_1}\Big|_{V_2=0} = 12.72\Omega$

$h_{11} = 12.72\Omega$

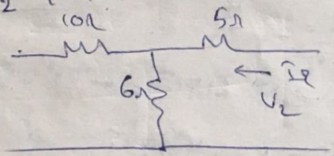
$h_{21} = \frac{I_2}{I_1}\Big|_{V_2=0}$



$I_2 = \frac{-I_1}{(6+5)} \times 6$

$\Rightarrow \frac{I_2}{I_1} = \frac{-6}{11} = -0.54\dot{5}$

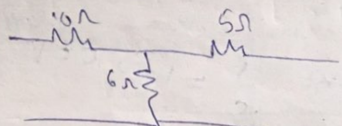
3) $h_{21} = \frac{V_1}{V_2}\Big|_{I_1=0}$



$V_1 = 6 I_2 \;;\; V_2 = 11\cdot I_2$

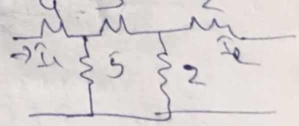
$\Rightarrow \frac{V_1}{V_2} = \frac{6}{11} = 0.545$

4) $h_{22} = \frac{I_2}{V_2}\Big|_{I_1=0}$



$I_2 = \frac{V_2}{11} = \frac{\frac{V_2}{11}}{V_2} = \frac{1}{11} = 0.09\,V$

2) $A = \frac{V_1}{V_2}\Big|_{I_2=0}$

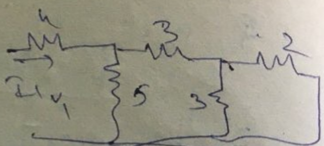


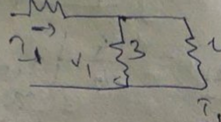
$V_1 = I_1 \times 6.5$

$V_2 = \frac{I_1}{\cancel{2}} \times \cancel{2} = I_1$

$A = \frac{\cancel{I_1} \times 6.5}{\cancel{I_1}} = 6.5$

$$B = -\frac{V_1}{I_2}\Big|_{V_2=0}$$





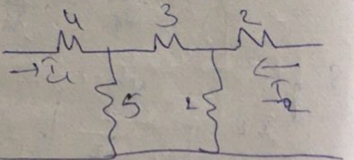
$V_1 = 6.25 \times I_1$

$I_2 = -\frac{I_1}{9} \times \frac{5}{2}$ $\quad \frac{I_1}{9} \times \frac{5}{2}$

$= -22.454\, I_1$

$B = 22.454\, I_1$

$$\frac{1}{C} = \frac{V_2}{I_1}\Big|_{I_2=0}$$



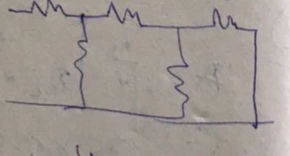
$V_2 = \frac{I_1}{2} \times 2$

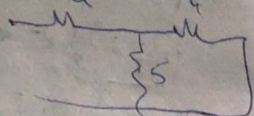
$I_1 =$

$\cancel{V_2 = \frac{I_1}{2} \times 2}$ $\quad \frac{1}{C} = 1 \Rightarrow C = 1$

$$-D = \frac{I_1}{I_2}\Big|_{V_2=0}$$

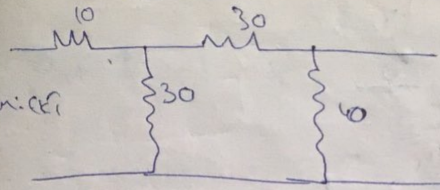
$$-D = \frac{I_1}{-8 \times 5/18}$$





Set - I :-

1)

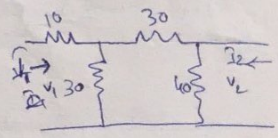


Given ckt

Y - Parameter eq

$I_1 = Y_{11} V_1 + Y_{12} V_2$

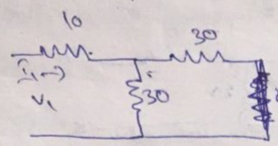
$I_2 = Y_{21} V_1 + Y_{22} V_2$



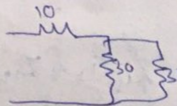
$Y_{11} = \frac{I_1}{V_1}\Big|_{V_2=0}$; $Y_{21} = \frac{I_2}{V_1}\Big|_{V_2=0}$

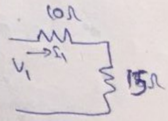
$Y_{12} = \frac{I_1}{V_2}\Big|_{V_1=0}$; $Y_{22} = \frac{I_2}{V_2}\Big|_{V_1=0}$

when $V_2 = 0$ then



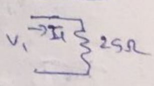
$V_1 = 25 \times I_1$





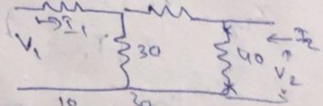
$* \therefore Y_{11} = \frac{I_1}{V_1}\Big|_{V_2=0}$

$Y_{11} = \frac{I_1}{25 \times I_1}$

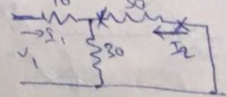


$Y_{11} = \frac{1}{25} = 0.04\ \mho$

$* \ Y_{21} = \frac{I_2}{V_1}\Big|_{V_2=0}$



$\cancel{-I_2 = \times \frac{30 \times 30}{30+30}\ \frac{V_1}{30+30}}$



$\cancel{I_2 = \times 25\ I_1 \times \frac{25}{60}}$

$-I_2 =$

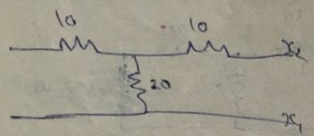
$$Y_{21} = \frac{I_2}{V_1}\Big|_{V_2=0}$$

$$-I_2 = \frac{I_1 \times 30}{30+30}$$

$$-I_2 = \frac{\cancel{30} \times I_1}{\cancel{60}\,2} = \frac{I_1}{2}$$

$$I_1 = -2I_2$$

2)



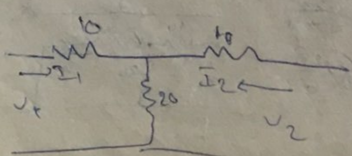
Z parameter:-

$$V_1 = Z_{11} I_1 + Z_{12} I_2$$

$$V_2 = Z_{21} I_1 + Z_{22} I_2$$

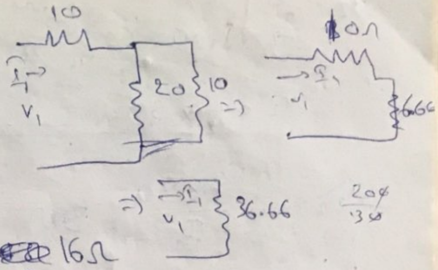
$$Z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0} \; ; \; Z_{21} = \frac{V_2}{I_1}\Big|_{I_2=0}$$

$$Z_{12} = \frac{V_1}{I_2}\Big|_{I_1=0} \; ; \; Z_{22} = \frac{V_2}{I_2}\Big|_{I_1=0}$$



when $v_2 = 0$ then

$$V_1 = 16.6 \times I_1$$

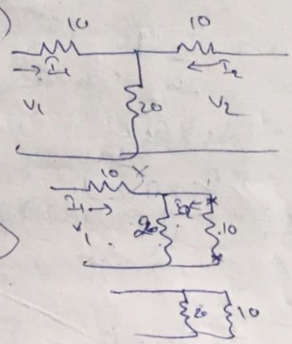


$$Z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0}$$

$$Z_{11} = \frac{16 \times I_1}{I_1} = 16\Omega$$

$$Z_{21} = \frac{V_2}{I_1}\Big|_{I_2=0} \quad V_2 = I_1 \times \left(\frac{200}{30}\right)$$

$$V_2 = 6.66 \times I_1$$



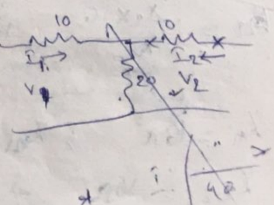
$$\boxed{Z_{21} = \frac{36 \times I_1}{I_1} = 36\Omega \qquad I_2 = -\frac{I_1}{(20+10)} \times 20}$$

$$\boxed{I_2 = -I_1 \times 0.66}$$

$$Z_{21} = \frac{V_2}{I_1} = \frac{+I_1 \times 0.66}{I_1} = +6.66\,\Omega$$

when $I_1 = 0$ then

$$Z_{12} = \frac{V_1}{I_2}\Big|_{I_1=0}$$



$$V_2 = \frac{I_2 \times}{20+10} \times 20$$

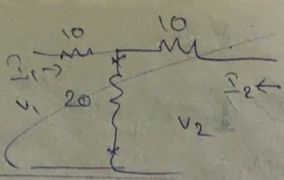
$$V_2 = I_2 \times 36.$$

$$I_2 = \frac{V_2}{36}$$

$$\text{now: } Z_{12} = \frac{V_1}{\frac{V_2}{36}} = \frac{36 V_1}{V_2} = \frac{V_2}{V_2} = 1$$

$(\because V_2 = 36 \times V)$

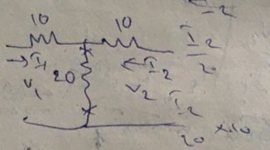
$$Z_{12} = 1\Omega$$



$Z_{22} = \frac{V_2}{I_2}\Big|_{I_1=0}$

$\therefore V_2 = I_2 \times 30$

$Z_{22} = \frac{\cancel{I_2}\times 30}{\cancel{I_2}} = 30\Omega$

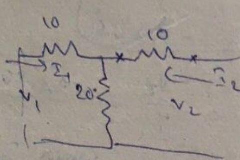


$Z_{12} = \frac{V_1}{I_2}\Big|_{I_1=0}$

$V_1 = \frac{I_2 \times 10}{20}$

$V_1 = I_2 \times 0.2$

$Z_{12} = \frac{\cancel{I_2}\times 0.2}{\cancel{I_2}} = 0.2\Omega$



$Z_{22} = \frac{V_2}{I_2}\Big|_{I_1=0}$

$V_2 = I_2 \times 10$

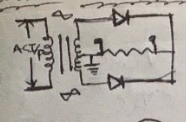
$Z_{22} = \frac{\cancel{I_2}\times 10}{\cancel{I_2}} = 10\Omega$

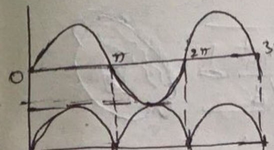
$\therefore Z_{11} = 16\Omega \; ; \; Z_{21} = 6.66\Omega \; ; \; Z_{12} = 0.2\Omega$

$Z_{22} = 10\Omega$

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 16 & 0.2 \\ 6.6 & 10 \end{bmatrix}\begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

Fullwave Rectifier:-





$V = V_m \sin\omega t$,

$I = I_m \sin\omega t$.

The total current in R_L $I = i_1 + i_2$.

While D_1 is conducting

$i_1 = I_m \sin\omega t \quad 0 \le t \le \pi$

$i_1 = 0 \quad \pi \le t \le 2\pi$.

In the -ve half cycle D_2 is conducting & D_1 is not conducting.

$i_2 = 0 \quad 0 \le t \le \pi$

$i_2 = I \sin\omega t \quad \pi \le t \le 2\pi$.

$I_{av} = I_{dc} = \frac{1}{\pi}\int_0^\pi I_m \sin\omega t \, d\omega t = \frac{I_m}{2\pi}\left[-\cos\omega t\right]_0^\pi$

$= \frac{I_m}{\pi}\left[(1) - (-1)\right] = \frac{2I_m}{\pi}$

$V_{av} = I_{dc} R_L = \frac{2I_m}{\pi} \times R_L = \frac{2V_m}{\pi}$

$I_{rms} = \sqrt{\frac{1}{\pi}\int_0^\pi I^2 \sin^2\omega t \, d\omega t}$

$= \sqrt{\frac{I^2}{2\pi}\int_0^\pi (1-\cos 2\omega t)\, d\omega t}$

$= \sqrt{\frac{I^2}{2\pi}\left[(\omega t)_0^\pi - \left[\frac{\sin 2\omega t}{2}\right]_0^\pi\right]}$

$= \sqrt{\frac{I^2}{2\pi}\left[\pi - 0\right]} = \sqrt{\frac{I^2}{2\cancel{\pi}} \times \cancel{\pi}} = \frac{I}{\sqrt{2}}$

$V_{rms} = \frac{I_m}{\sqrt{2}} R_L = \frac{V_m}{\sqrt{2}}$

$V'^2_{rms} = V_{rms}^2 - V_{dc}^2 = \frac{V_m^2}{2} - \frac{4V_m^2}{\pi^2}$

$= \frac{(\pi^2 - 8)V_m^2}{2\pi^2}$

$\Rightarrow V_{rms} = (0.0947)V_m^2$.

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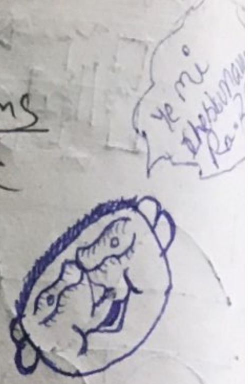
$$\gamma = \frac{\text{all rms AC components of output}}{\text{DC components.}} = \frac{V'_{rms}}{V_{dC}}$$



$$= \frac{I'_{rms}}{I_{AC}} = \frac{V_{dC}\sqrt{\frac{V_{rms}^2}{V_{dC}^2}-1}}{V_{dC}.}$$

$$\eta = \frac{\text{dc output power}}{\text{AC input power}} = \sqrt{\frac{V_m^2}{2} \times \frac{\pi^2}{4V_m^2}} - 1$$

$$= 0.4834$$

If diode forward resistance and transformer resistance included then

$$P_{ac} = \frac{V_{dc}^2/R_L}{V_{rms}^2/R_L+r_f} = \frac{V_{dc}^2\left(1+\frac{r_f+r_s}{R_L}\right)}{V_{rms}^2} = 0.81$$

$$P_{dC} = \frac{V_{dc}^2/R_L}{V_{rms}^2/R_L}$$

* Maximum efficiency is.

$$\eta = 0.81056.$$

MAX % efficiency is 81.1%

PIV :- for +ve cycle, D_1 is forward bias and D_2 is reverse bias, at that time, the diode is with stand without destroying the junction for maximum reverse voltage V_m.

||ly for -ve cycle, D_1 is reverse bias and D_2 is forward bias, at that time, the diode is with stand without damaging the junction for +ve ~~cycle~~, maximum reverse voltage V_m

$\therefore$ Total $= V_m + V_m = 2V_m$.

Network Analysis:-

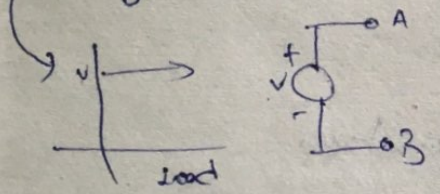
Voltage:- $V = iR$ $\quad i = \frac{Q}{t}$

Power:- $P = Vi$

Circuit Elements:

- Active Elements
  - voltage source (voltage across terminal)
    - ideal V.S
    - Practical V.S
  - current source (i)
    - ideal C.S
    - Practical C.S
- Passive Elements
  - linear Elements
  - non linear element
    - unilateral
    - bilateral

voltage across terminals



Resistance:-

$$i = \frac{V}{R}$$

$$i = \frac{v}{R} \qquad \left(\because i = \frac{dq}{dt}\right)$$

$$\therefore v = R \cdot \frac{dq}{dt} \qquad \text{Units:- ohms } \Omega$$

Inductance:-

$$V = L\frac{di}{dt}$$

$$\therefore di = \frac{1}{L} V . dt$$

Integrating B.S $\qquad$ units:- henry

$$\int_0^t di = \int_0^t \frac{1}{L} \cdot V . dt$$

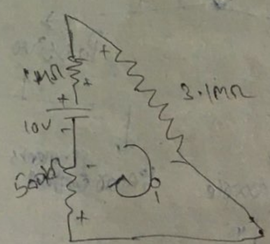
Capacitance:-

$C = \frac{Q}{V}$ (or) $C = \frac{q}{v}$ units:- farads.

$i = C\frac{dv}{dt}$

$dv = \frac{1}{C} \cdot i \cdot dt$

* **KVL:-**



$10V - i\,1m - 3.1m - 500m$

$10V - 10^{-3} - 3.1\times10^{-3} - 500$

* **Voltage division:-**

$\frac{\text{Total voltage}}{\text{Sum of Resistance}} \times$ That Resistance

* **Current division:-**

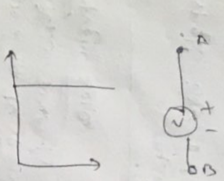
$\frac{\text{Total current}}{\text{Sum of Resistan.}} \times$ ~~That~~ opposite resistance.

* **Power Resistance:-**

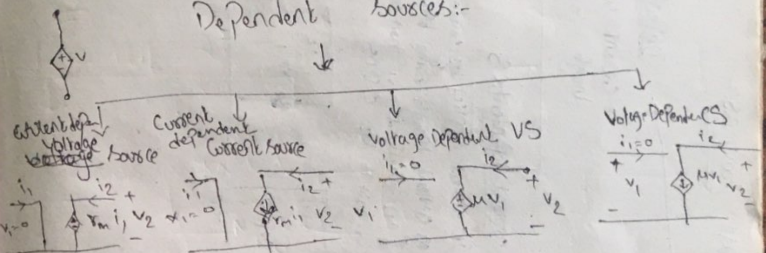
$P = i\,v$

Ideal voltage & Current sources:-

Independent sources
↓
voltage source — Current source.



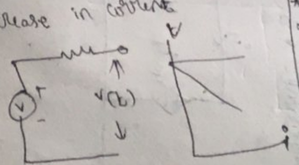
Dependent sources:-



Independent sources:-

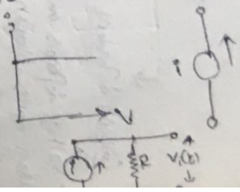
(i) Independent V.S

* Maintains Constant voltage no changes occurs
* Independent current through source should have zero internal resistance
* In practical independent VS have some internal resistance due to which voltage decrease with increase in current.



Independent C.S

* which gives constant current that does not changes when changes takes place in network
* r_0 has infinite internal resistance
* In practical independent CS have some internal resistance due to which current decreases with increase in voltage.



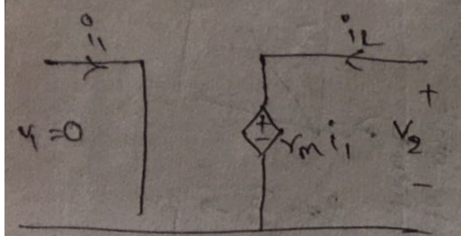
Dependent ~~voltage~~ sources:-

Dependent voltage source

* Depends on current through branches

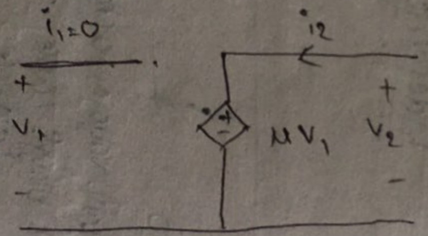
Current dependent V.S

* Voltage depends on current through some branch of Electrical Network then source is called current dependent V.S



Voltage dependent V.S

* If voltage " on voltage across some branch of electric N.W than source is said to be voltage dependent voltage source.

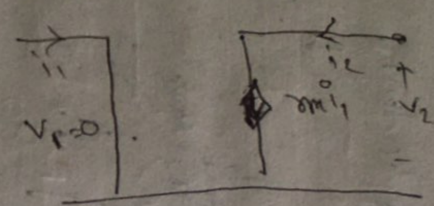


Dependent current source.

* Current supplied by a source depends current through some branches

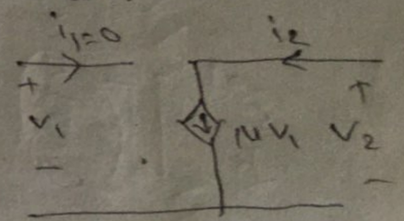
current dependent C.S

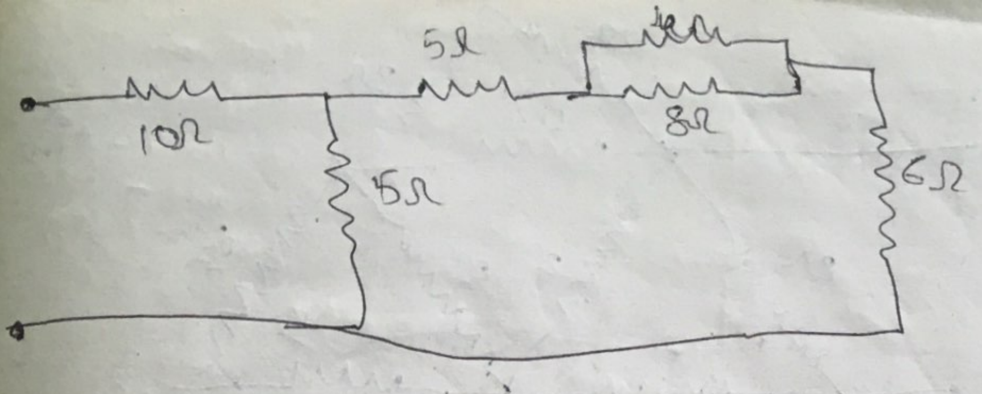
If current supplied by source depends on current through some branch of an electrical N.W than source is said to be CDCS

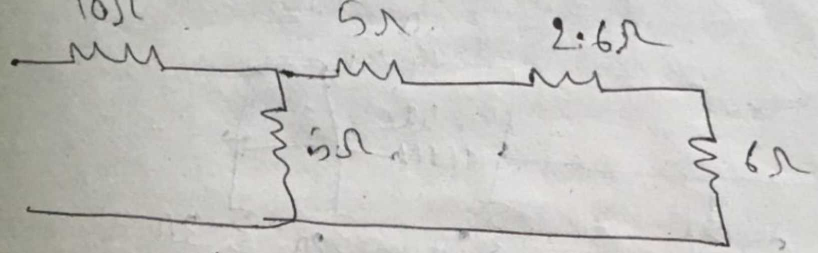


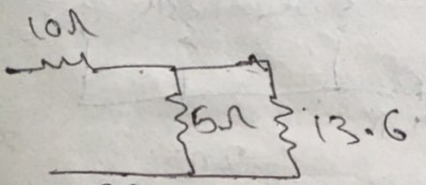
voltage dependent C.S

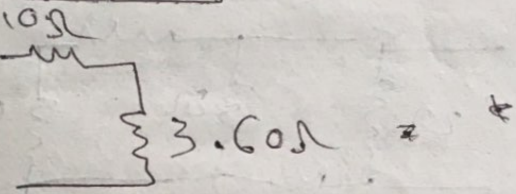
If current supplied by a source depends on voltage across some branch of an electric N.W then source is to be VDCS

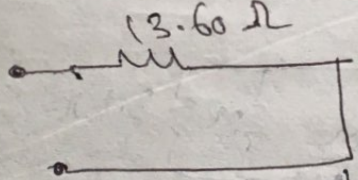



10Ω
5Ω
8Ω
15Ω
6Ω

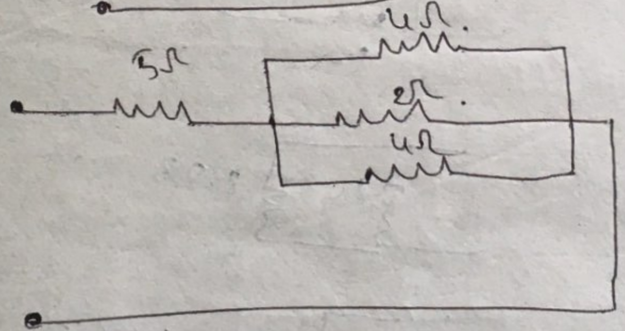

10Ω
5Ω
2.6Ω
5Ω
6Ω

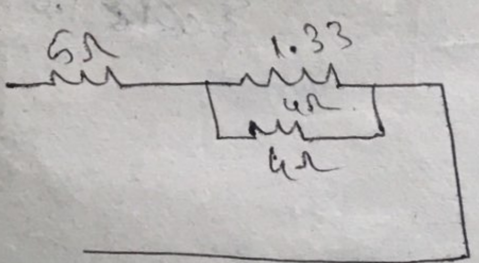

10Ω
5Ω
13.6

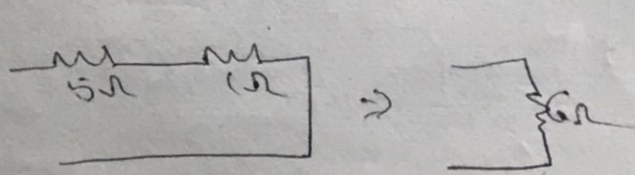

10Ω
3.60Ω

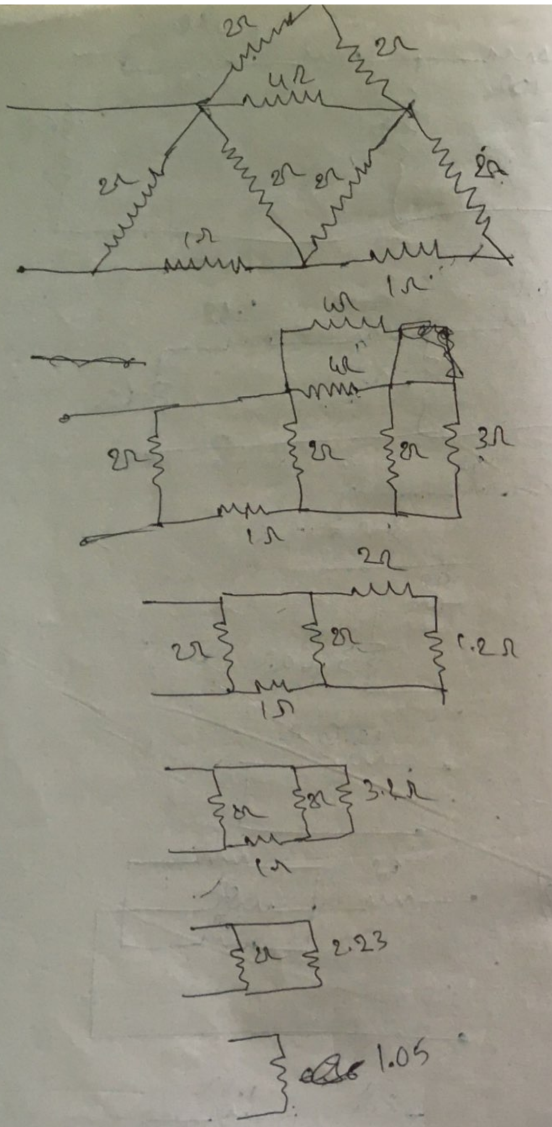

13.60 Ω

2)

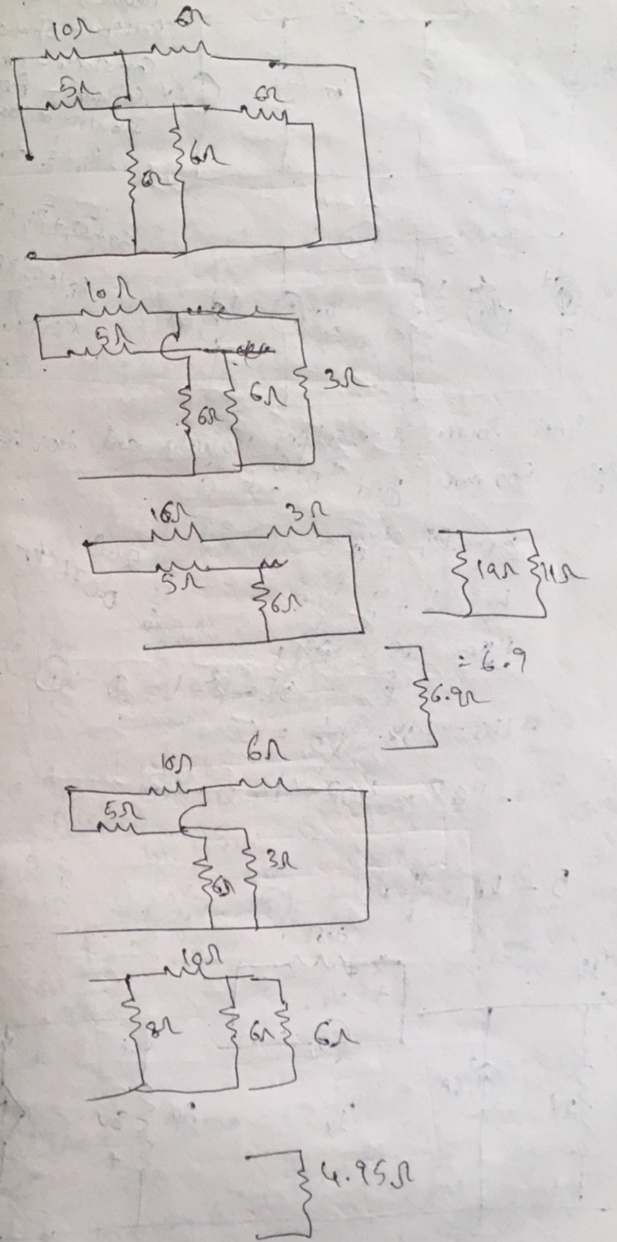

5Ω
4Ω.
2Ω.
4Ω


5Ω
1.33
4Ω.
4Ω

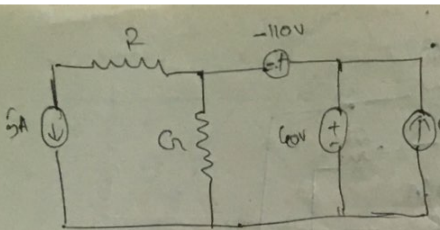

5Ω
1Ω
⇒
6Ω



2Ω
2Ω
4Ω
2Ω
2Ω
2Ω
2Ω
2Ω
1Ω
1Ω
6Ω
6Ω
2Ω
2Ω
2Ω
3Ω
1Ω
2Ω
2Ω
2Ω
1.2Ω
1Ω
2Ω
2Ω
3.2Ω
1Ω
2Ω
2.23
1.05

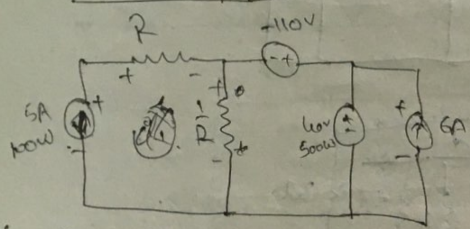


10Ω
6Ω
5Ω
6Ω
6Ω
6Ω
10Ω
5Ω
6Ω
6Ω
3Ω
10Ω
3Ω
5Ω
6Ω
19Ω
11Ω
= 6.9
6.9Ω
10Ω
6Ω
5Ω
3Ω
6Ω
10Ω
8Ω
6Ω
6Ω
4.95Ω



Power – watts
Resistance – ohms
Conductance – Mho's
Capacitor – Farads
Inductor – henry

$-100 + Ri_1 + \frac{1}{R}i_1 + 110 + 500 + 6 = 0$



$-50 + \cancel{Ri_1} + Ri_1 + 110 + 40 + 6 = 0$

$\cancel{Ri_1 + 106} + Ri_1^2 = 0$

$\cancel{Ri_1(106 + Ri_1) = 0}$

$R_1 = -406$

The 5Amp source is supplying 100 watts and 40V source supplying 500 watts find 'R' and 'G'

$\cancel{5 - Ri_1 - \frac{1}{R}i_1 = 0} \rightarrow (1)$

$5 = R + \frac{1}{R}$

$5R - R^2 - 1 = 0 \rightarrow (1)$

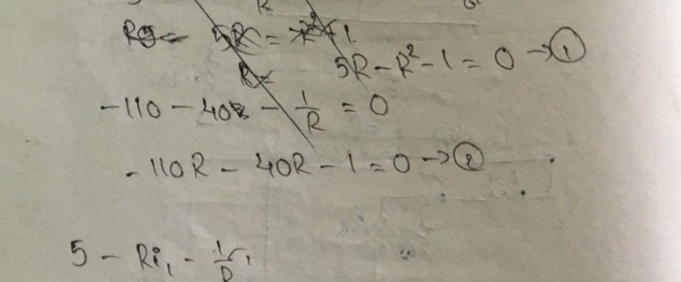
$-110 - 40R - \frac{1}{R} = 0$

$-110R - 40R - 1 = 0 \rightarrow (2)$

$R = 26\Omega$

$G = 0.0766 (\mho)$

$5 - Ri_1 - \frac{1}{R}i_1$



$R = 2$, $i_{in} = \frac{V}{R} = 1$

$R \times 2 \times$

$P = Vi$

$\Rightarrow P = V \cdot I$

$P = Vi$

$\Rightarrow P = V$

$i_x = 1$

$V = \frac{i}{2} = \frac{8}{2} = 4$

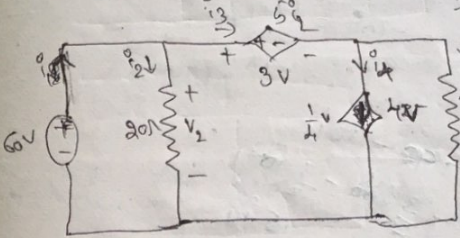
$V_x =$

$i = \frac{V}{R}$

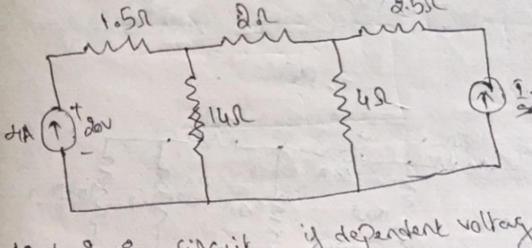
$P = V \cdot i$

$= V \cdot \frac{V}{R}$

1)



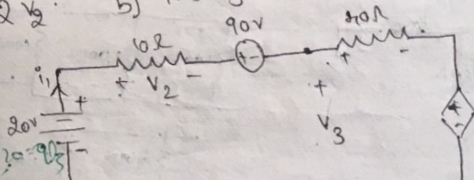
2)



3) find i_1 in circuit if dependent voltage source is labelled

a) $2V_2$ b) $1.5V_3$ c) $-15i_1$

leaving –
entering +



$V_{i_3} = 40i_1 + 1.5V_3$

$-0.5V_3 = 40i_1$

$V_3 = 80i_1$

$10i_1\ 20i_1$

$-90 - 10i_1 - 20 = 90$

$V_3 = -110 - 10i_1 - 20$

$70 + 10i_1$

$i_1 = -1A$

$-20 + 10i_1 + 90 + 40i_1 + 20i_1 = 0$

$V = i_1R$

$20 = i_1R$

$\frac{20}{10} = i_1$

$i_1 = 2A$

$V_2 = i_1R$

$-20 + 10 + 90 + 40 + 10i_1 = 0$

$120 = -10i_1$

$-120 = 10i_1$

$i_1 = -12A$

$i_1 = \frac{120}{10}$

$i_1 = -12A$

$V_2 = 10i_1$

$i_1 = -12A$

$v_2 = i_1 R$

$\Rightarrow v_2 = -12x$

$-90 - 10 i_1 + 20 = v_3$

$-70 = 10 i_1$

$i_1 = -7A$

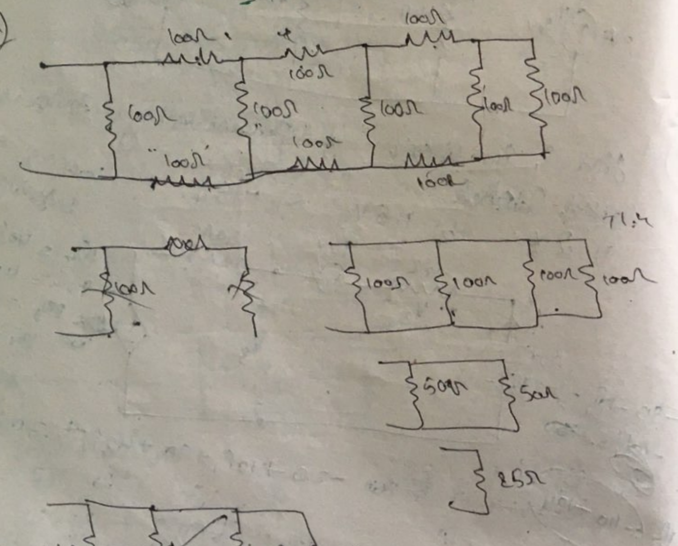
$v_3 = -90 - 10 i_1$

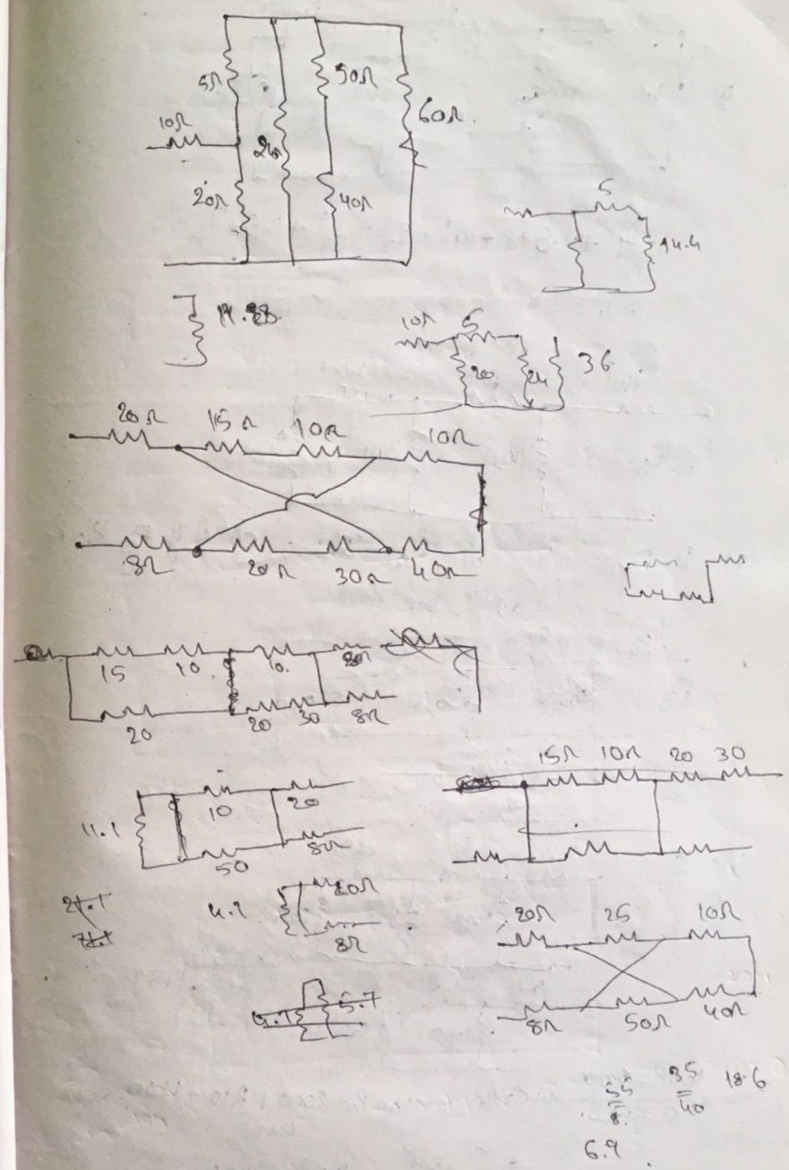
$1.5 v_3 = -\frac{3}{2} \times 90 - \frac{3}{2} 10 i_1$

$= -135 - 15 i_1$

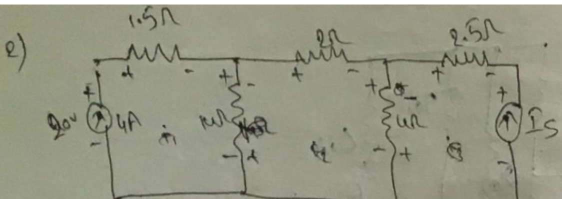
$-135 - 15 i_1$

a)



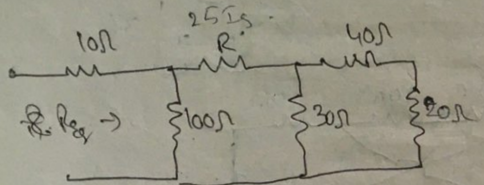


e)



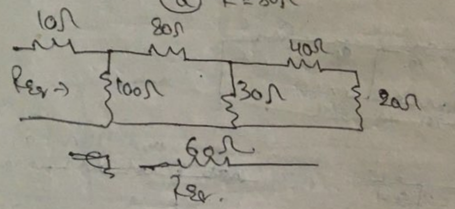
$-4 + 1.5 i_e + 14i + 2i + 4i + 2.5 + I_s = 0$

$-4 + 24i + i_s = 0$

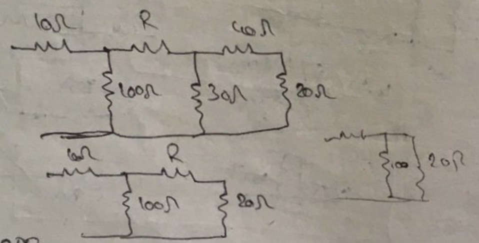


a) $R = 80\Omega$; b) $R_{eq} = 80\Omega$; c) R if $R = R_{eq}$

(a) $R = 80\Omega$



b)



$\frac{100R+2000}{R+120} + 10 = 80 \Rightarrow \frac{100R + 2000 + R10 + 1200}{R+120} = 80$

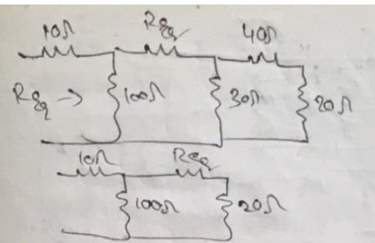
$\frac{110R + 3200}{R+120} = 80$

$110R + 3200 = 80R + 9600$

$30R = 6400$

$R = 213.33$

c)



$\frac{(R_{eq}+20)\times 100}{(R_{eq}+20)+100} + 10 = R_{eq}$

$\frac{R_{eq}100 + 2000}{R_{eq}+120} + 10 = R_{eq}$

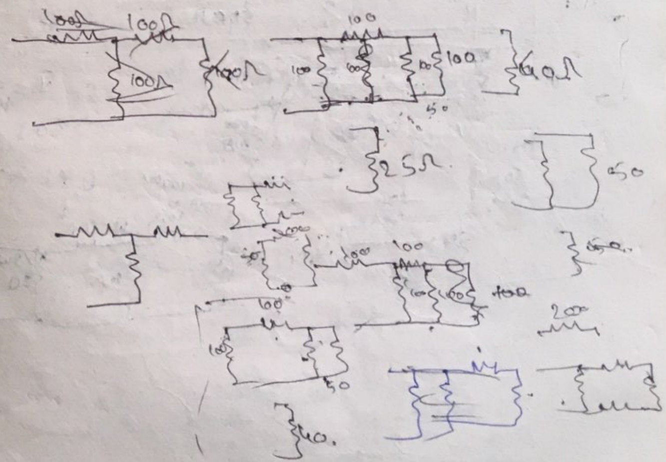
$R_{eq}100 + 2000 + 10R_{eq} + 1200 = R_{eq}^2 + 120R_{eq}$

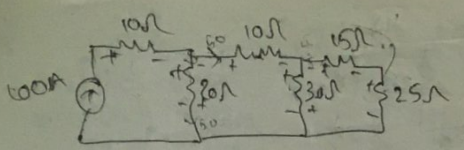
$110R_{eq} + 3200 = R_{eq}^2 + 120$

$-10R_{eq} + 3080 = R_{eq}^2$

51.7895

32)





25A

$100 - 10 - 20.$

$V = iR$

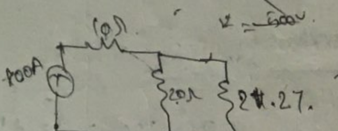
$i = \frac{100}{20} = 5 \cdot 0A$

2.7

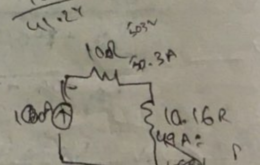
$V = iR$

$V = 50 \times 10$

$V = 500V$

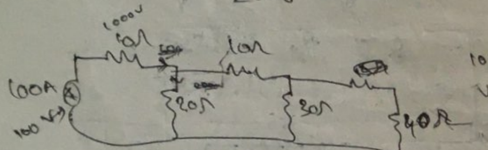


$\frac{100}{41.27} \times 21.27$



$i = \frac{100}{20.16} \times 10 = 496.$

$V = iR$

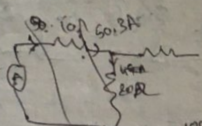


100A

$V = Ri$

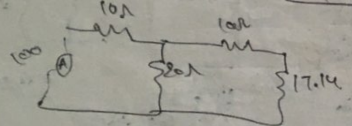
$I_{10} = \frac{V}{10}$

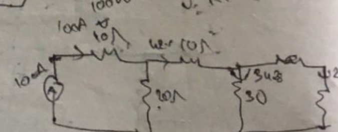
$50.3 = \frac{V}{10}$

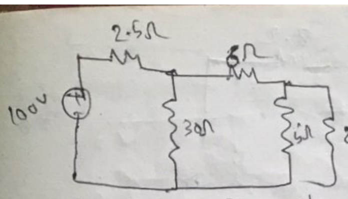


100V

$V = Ri$







Find the Power observed by each resistor.

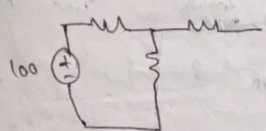
$P_{2.5\Omega} =$

1) If a current enters into the terminal of element the power is said to be absorbed

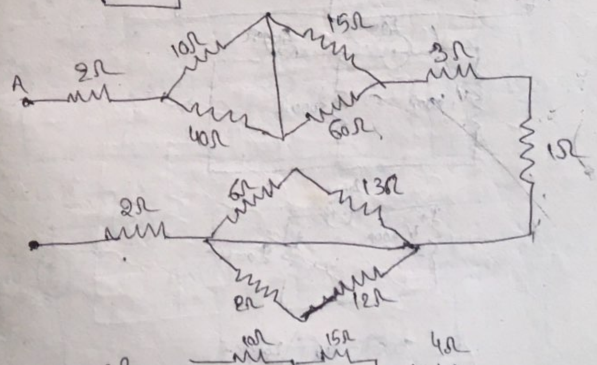
2) –ve terminal element to power is said to be delivered

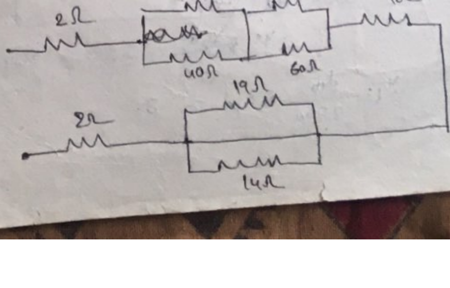
3) R, L, C → absorbed powers

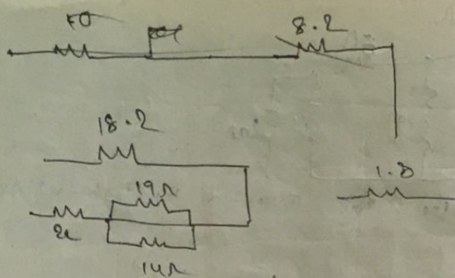
4) V, i → may absorb (or) delivered.



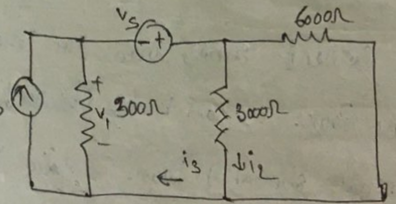
P)





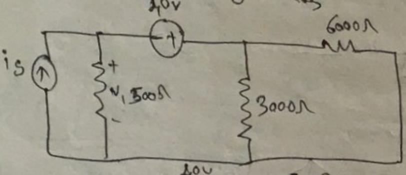


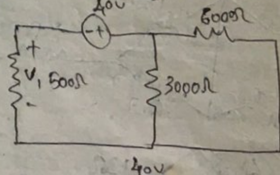
38)

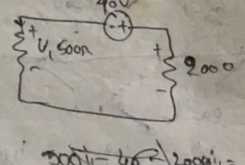


Ans. let $V_s = 40V$ and find i_s ; b) let $i_s = 50A$ and find V_x Calculate ratio of V_x/i_s

here $i_s=0$ open ckt
$V_s=0$ short "

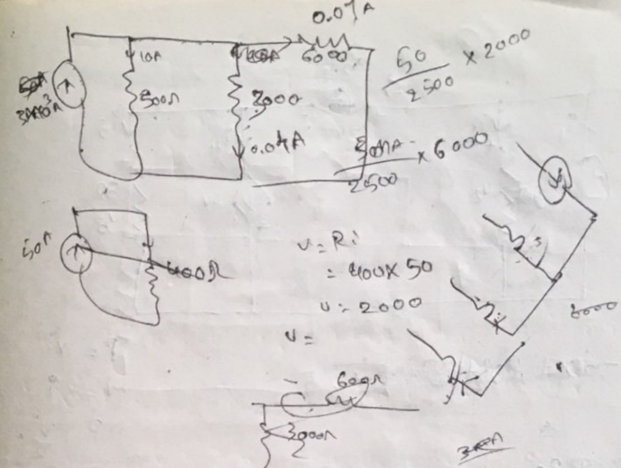






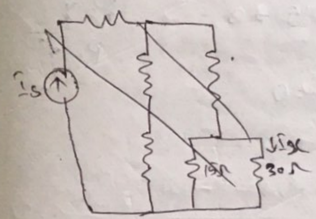
$$v_1 = \frac{40}{2500} \times 500 = 8.$$

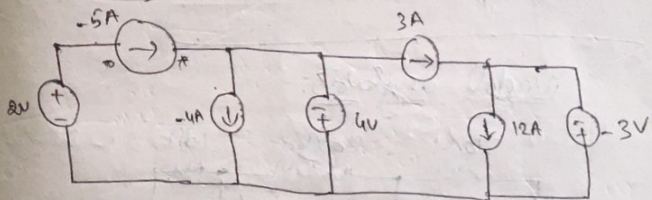
b)

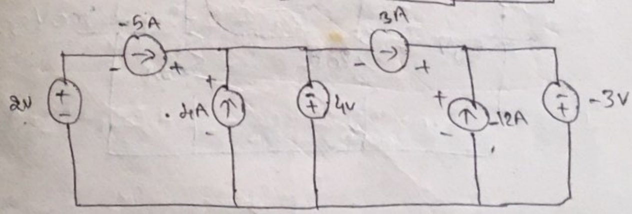


$$\frac{3mA}{6500} \times 461.5$$

P)

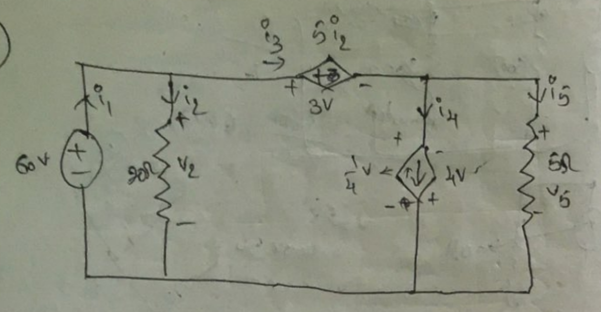






$$P_{2V} = V \times i_a = 2 \times -5 = -10 \text{ Watts}$$

1)



$P = Vi$

$V = Ri$

$\Rightarrow P = \frac{V^2}{R}$

$P = i^2 R$

$R = \frac{V}{i}$

$R = V^2$

~~$-60 + 20i_2 + 3 + i_4 + 5i_5 = 0$~~

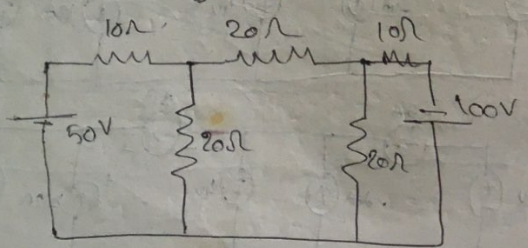
$i_1 + 20i_2 + 5i_2 + i_4 + i_5 = 0$

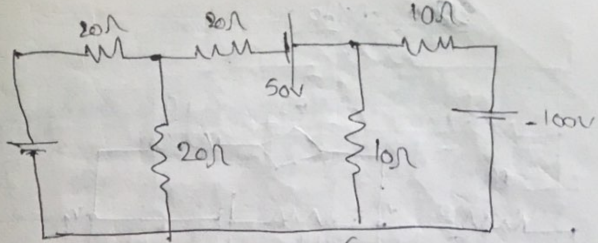
$6i_2 + i_4 + i_5 = 0$

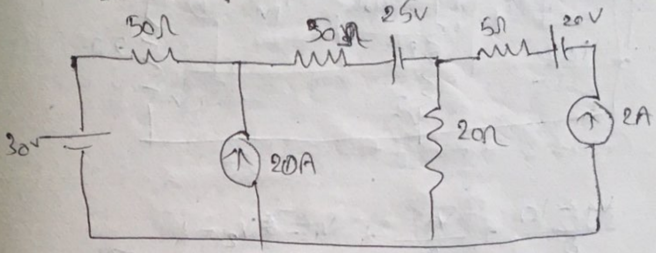
By using ohms law:-

$i_1 = \frac{60}{R}$

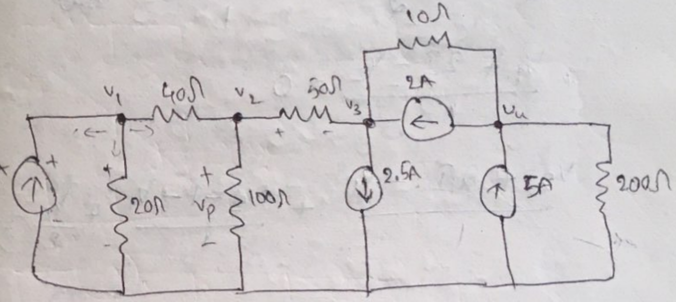
Nodal anylasis:-







4)



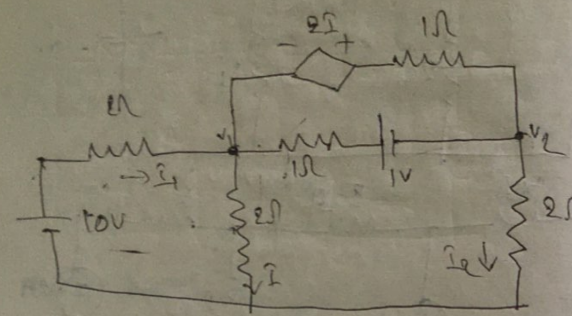
$$10 + \frac{V_1}{20} + \frac{V_1 - V_2}{40} = 0$$

$$\frac{V_2 - V_1}{40} + \frac{V_2}{100} + \frac{V_2 - V_3}{50} = 0$$

$$\frac{V_3 - V_4}{10} + \frac{V_3 - V_2}{50} + 2.5 - 2 = 0$$

$$\frac{V_4 - V_3}{10} + 2 - 5 + \frac{V_4}{200} = 0$$

Super node:-



$$\frac{V_1-10}{2} + \frac{V_1}{2} + \frac{V_1 - V_2 - 1}{1} + \frac{V_1 + 2I - V_2}{1} = 0$$

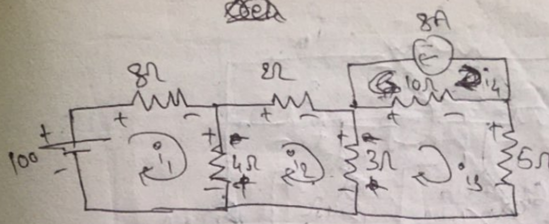
$$\frac{V_2 + 2I - V_1}{1} + \frac{V_2 - 1 - V_1}{1} + \frac{V_2}{2} = 0$$

$V_1 - 10 + V_1 + 2V_1 - 2V_2 - 2 + 2V_1 + 4I - 2V_2 = 0 \to ①$

$2V_2 + 4I - 2V_1 + 2V_2 - 2 - 2V_1 + V_2 = 0 \to ②$

$2V_1 - 10 + 2V_1 - \cancel{2V_1} - 2V_2 - 2 + \cancel{2V_1} + 4I - 2V_2 = 0$

Sol



$100 - 8i_1 - 4i_1 + 4i_2 = 0 \to ①$

$-4i_2 + 4i_1 - 2i_2 - 3i_2 + 3i_3 = 0 \to ②$

$-3i_3 - 10i_3 + 10i_4 - 5i_3 = 0 \to ③$ $+3i_2$

$10i_4 = -8A$

$-100 + 8i_1 + 4i_1 - 4i_2 = 0 \to ①$

$4i_2 - 4i_1 + 2i_2 + 3i_2 - 3i_3 = 0 \to ②$

$3i_3 - 3i_2 + 10i_3 - 10i_4 + 5i_3 = 0 \to ③$

$i_4 = 8$

for ①:-

$-100 + 12i_1 - 4i_2 = 0$

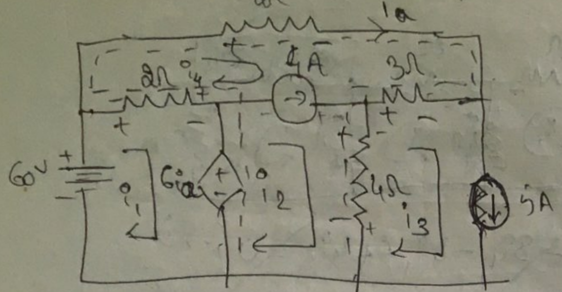
②:-

$9i_2 - 4i_1 - 3i_3 = 0$

③:-

$18i_3 - 3i_2 - 10i_4 = 0$

$18i_3 - 3i_2$



$-2i_4 - 60 + 2i_1 + 6i_a = 0 \to (1)$

$-\cancel{6i_a} \; i_2 - i_4 = 4 \to (2)$

$\cancel{4i_3 - 4i_2 + 3i_3 - 3i_4 - 8 = 0}$

$+i_3 = 5 \qquad i_2 = 4 + i_4$

$i_3 = +5 \to (3)$

$-6i_a + 2i_4 + 8i_4 - 2i_1 + 3i_4 - 3i_3 + 4i_2 - 4i_3 = 0$ $\to (4)$

$-60 + 2i_1 + 6i_a = 0$

$i_2 - i_4 = 4 \qquad i_3 = +5$

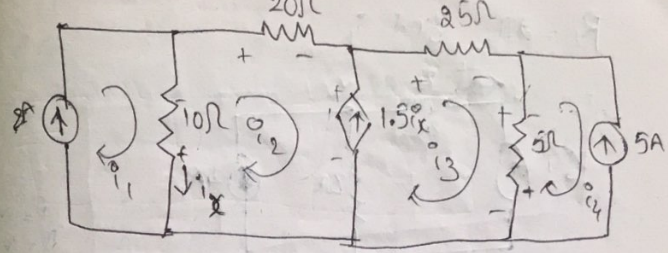
$-6i_a + 11i_4 - 2i_1 - 7i_3 + 4i_2 = 0$

$-6i_a + 11i_4 - 2i_1 + 35 + 4i_2 = 0$

$-6i_a + 11i_4 - 2i_1 + 35 + 16 + 4i_4 = 0$

$-6i_a + 19i_4 - 2i_1 + 51 = 0$

$-6i_a$



$i_1 = 2$

$\cancel{-10i_2 + 10i_2 + 20i_2 + 1.5i_x = 0}$

$\cancel{-1.5i_x + 25i_3 + 5i_3} - 5i_4 = 0$

$\cancel{i_1 - i_2 = 2}$

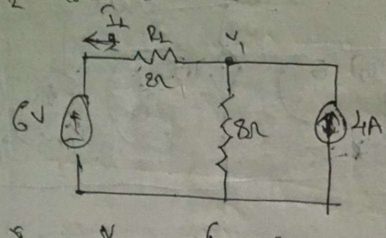
$i_1 = 2$

$i_1 - i_2 = i_x$

$-1.5i_x + 25i_3 + 5i_3 - 5i_4 = 0$

$i_4 = 5$

$R_L = 2\Omega$ find i_L



$P = vi$
$P = v4$
$P = i^2R$
$P = 16 \times 8$
$= 128 w$

$i_L = \frac{V}{R_L} = \frac{6}{2} = 3A.$

$\frac{V_1 - 6}{2} + \frac{V_1}{8} - 4 = 0$

$4V_1 - 24 + V - 32 = 0$

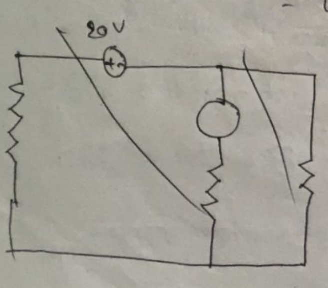
$5V_1 - 56 = 0$

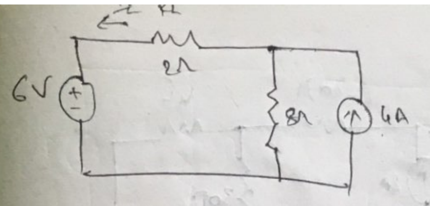
$V_1 = \frac{56}{5} = 11.2V$

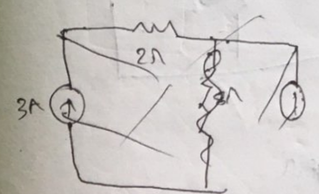
$i_L = \frac{V_1}{R} = \frac{11.2 - 6}{2} = \frac{5.2}{2} = 2.6A.$

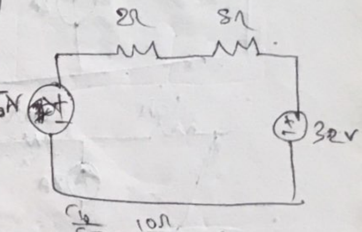
$P = V_1 \times i_L$

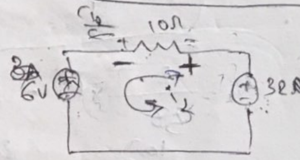
$= 11.2 \times 4 = 44.8$ watts









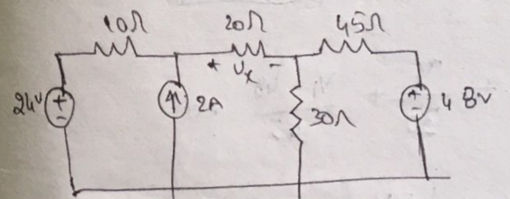


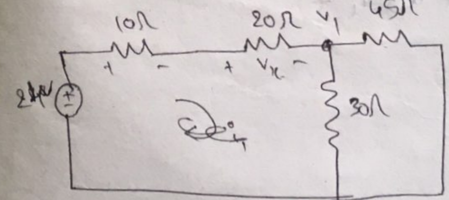
$-32 + 10i_L + 6 = 0$

$26 = 10i_L$

$2.6A = i_L$

Superposition Th:-





$i_1 = \frac{V_1 - 24}{30} = \frac{9-24}{30} = \frac{-15}{30} = -\frac{1}{2} = -0.5$

$i_1 = 0.5$

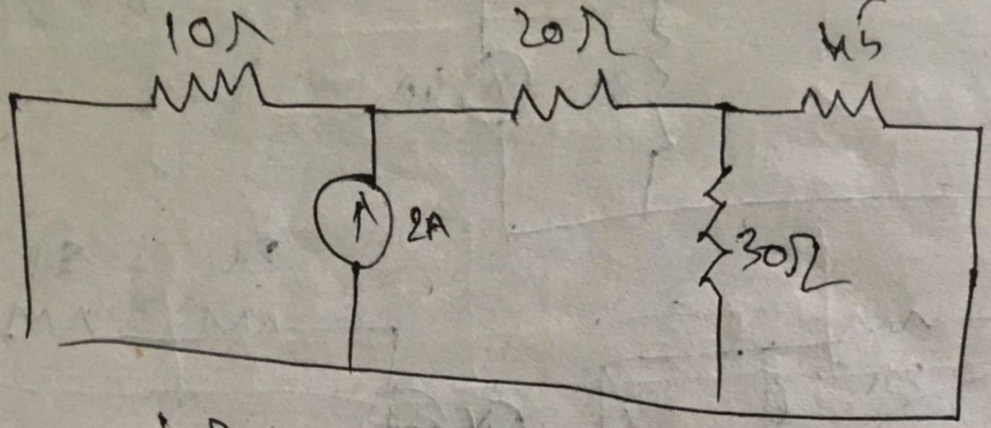
$\frac{V_1 - 24}{30} + \frac{V_1}{30} + \frac{V_1}{45} = 0$

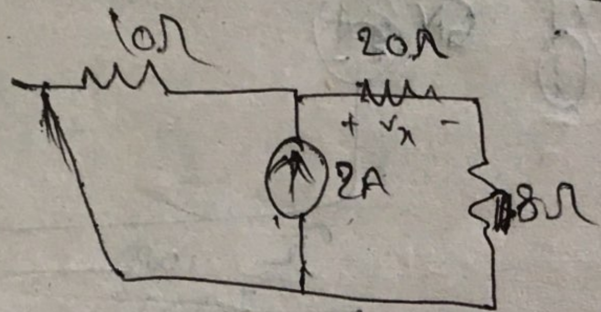
$45V_1 - 1080 + 45V_1 + 30V_1 = 0$

$120V_1 = 1080$

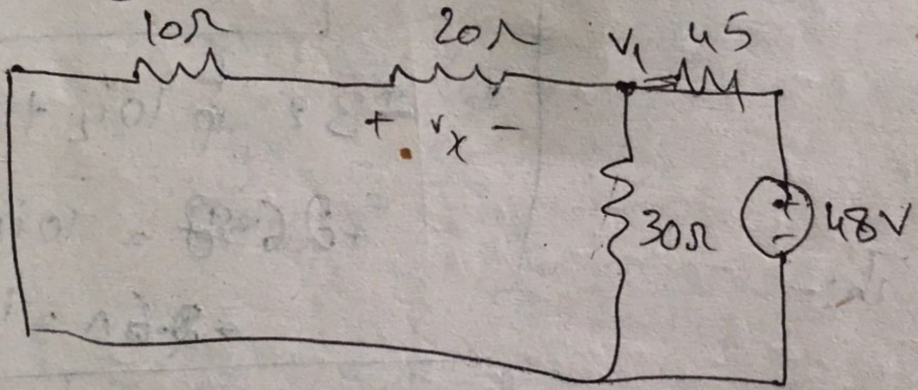
Scanned with CamScanner

$v_1 = 9V$





$$V_x = \frac{2}{38} \times 18 = 0.9V$$



$$\frac{V_1}{38} + \frac{V_1}{30} + \frac{V_1 - 48}{45} = 0$$

$$45V_1 + 4.5V_1 +$$