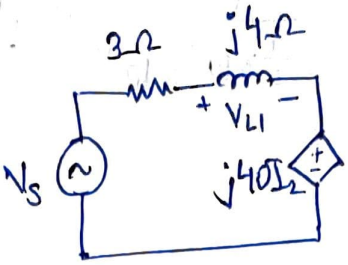
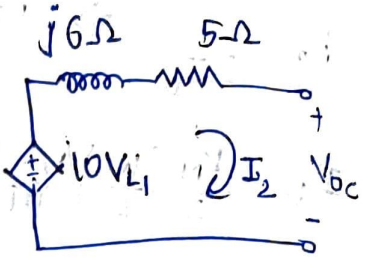
EE02037 Assignment

1. $V_{Th} = V_{oc} = 10V_{L1}$





$I_2 = 0$

So, in first loop —

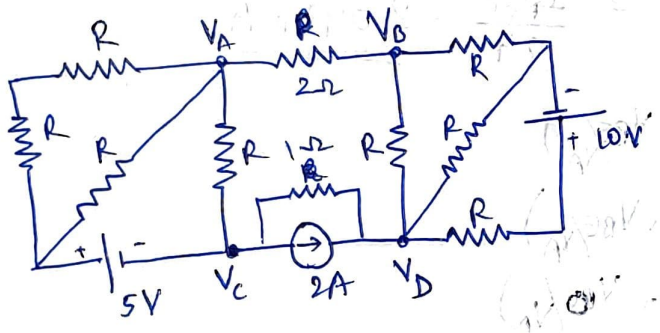
$$V_{L1} = \frac{j4}{3+j4} \cdot V_s$$

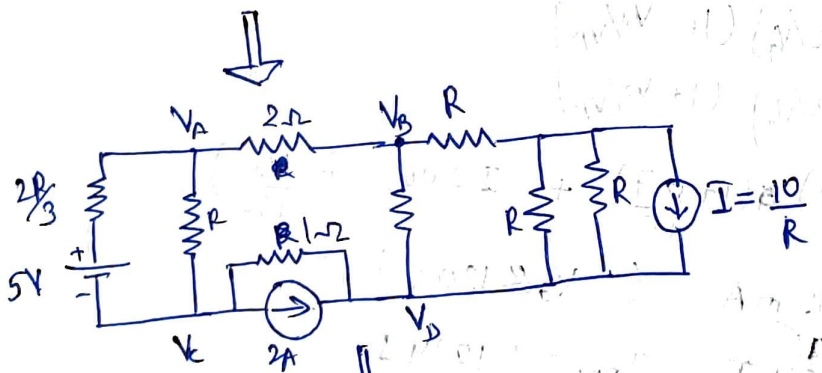
$$= \frac{(3-4j)4j}{25} \times 100\angle 53.12^\circ = \frac{5\angle -53.12^\circ \times 4\angle 90^\circ \times 100\angle 53.12^\circ}{25}$$

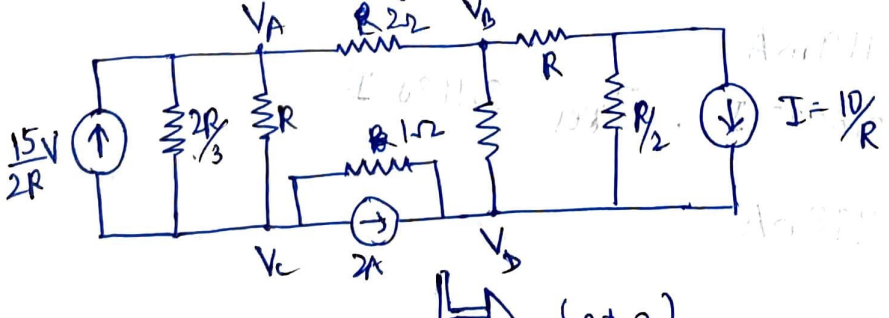
$$\therefore V_{L1} = 80\angle 90^\circ$$

$$\therefore V_{Th} = 800\angle 90^\circ V$$

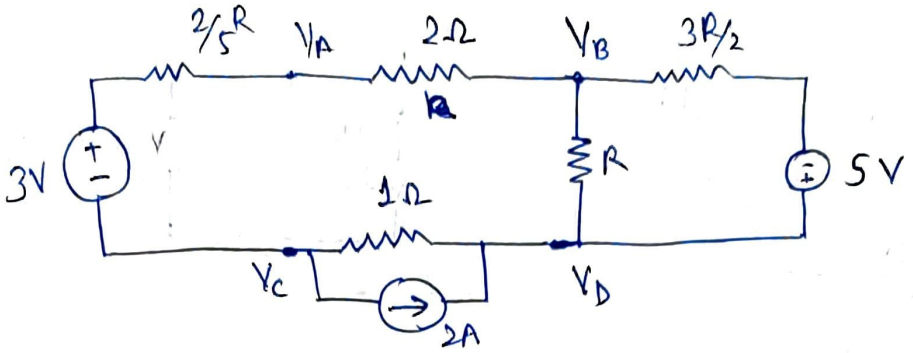
2.

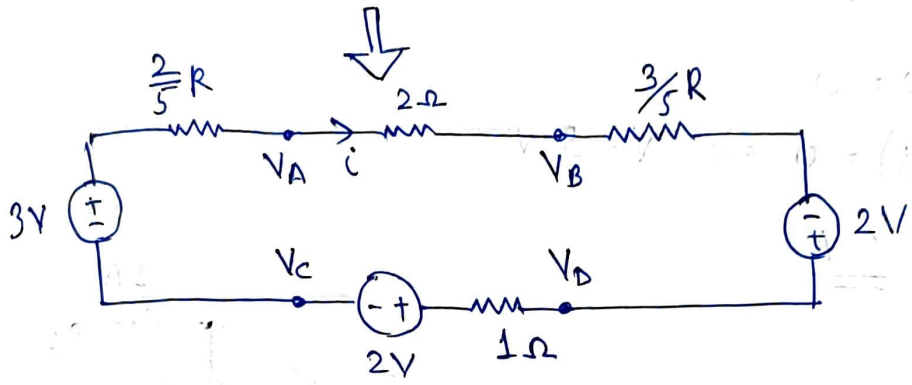






(p.t.o.)

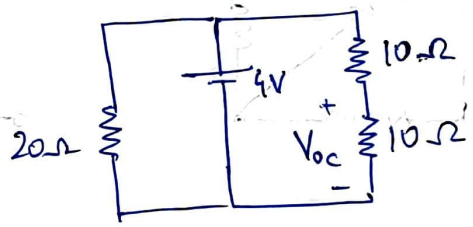




Now, $V_A - V_B = 6\,V \Rightarrow i = 3\,A$

$\therefore V_C - V_D = -2 - 3\times 1 = -5\,V$

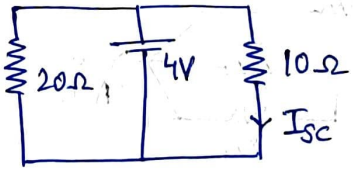
3. for V_{Th} $(= V_{oc})$



$\therefore V_{oc} = \frac{10}{20} \times 4 = 2V$

$\therefore \boxed{V_{Th} = 2V}$

for I_{sc},



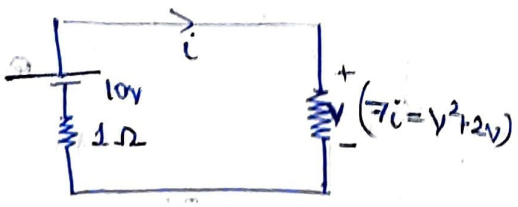
$$I_{sc} = \frac{20}{10+20} \times \frac{4}{10 \| 20}$$

$$= \frac{2}{3} \times 4 \times \frac{3}{20} = \frac{4}{10}\,A = 0.4\,A$$

$$\therefore R_{Th} = \frac{V_{Th}}{I_{sc}} \Rightarrow \boxed{R_{Th} = 5\Omega}$$

4. Now, $V^2 + 2V = 7i$ ——— (1)

$10 = V + i$ ——— (2)



putting (2) in (1) —

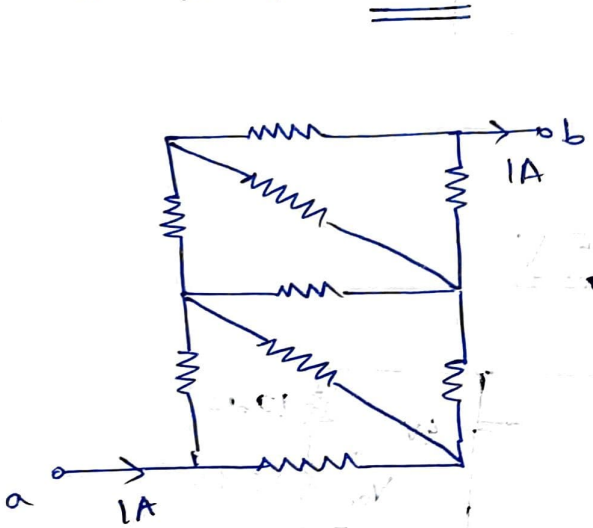
$V^2 + 2V = 7(10 - V)$

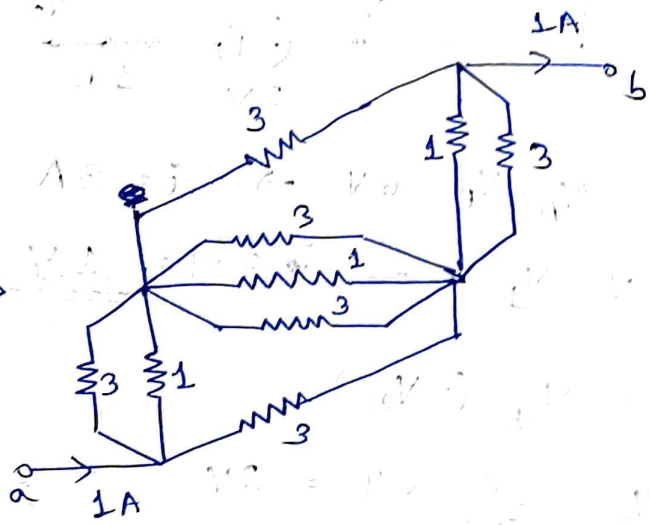
$\Rightarrow V^2 + 9V - 70 = 0$

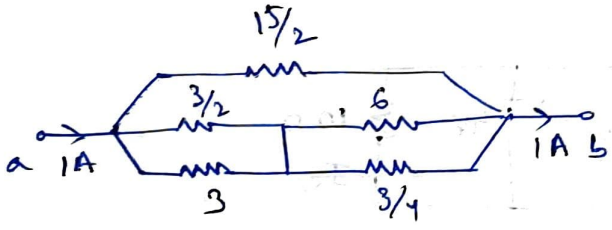
$\Rightarrow (V+14)(V-5) = 0 \Rightarrow V = 5\ V$

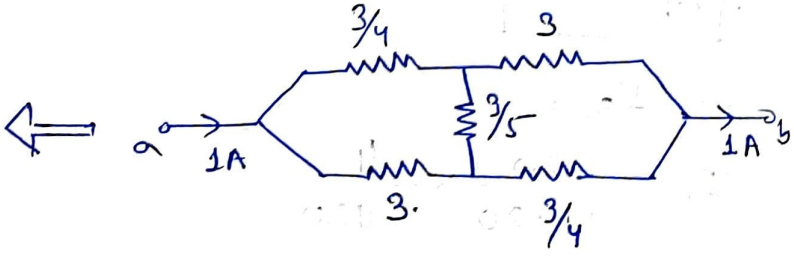
$\therefore I = 10 - V = \underline{\underline{5\ A}}$

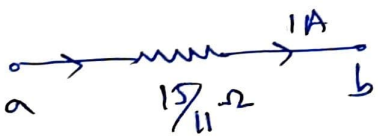
5.





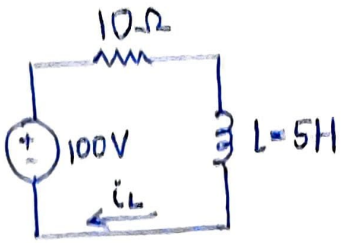






$\therefore V_{ab} = \frac{15}{11} V$

6.



$$100 = 10i + 5\frac{di}{dt}$$

$$\Rightarrow \boxed{\frac{di}{dt} + 2i - 20 = 0}$$

$$\frac{di}{i-10} = -2dt \Rightarrow \ln\left|\frac{i(t)-10}{i(0)-10}\right| = -2t\Big]_0^t$$

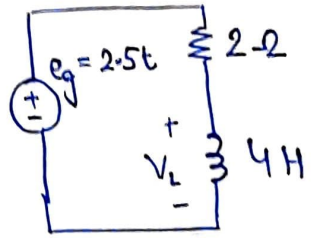
$$\Rightarrow |i-10| = 10e^{-2t}$$

$$\Rightarrow \boxed{i_L = 10(1-e^{-2t})}$$

$$\therefore E = \frac{1}{2}Li_L^2 = \frac{5}{2}\times 10^2(1-e^{-2t})^2 \Rightarrow \boxed{E(t) = 250(1-e^{-2t})^2}$$

$$\lim_{t\to\infty} E(t) = 250\ \text{J}$$

7.



$$e_g = 2i + 4\frac{di}{dt}$$

$$\Rightarrow \frac{di}{dt} + \frac{1}{2}i = \frac{5}{8}t$$

$$\Rightarrow \frac{d}{dt}(ie^{t/2}) = \frac{5}{8}te^{t/2}$$

$$\Rightarrow i(t)e^{t/2} = \frac{5}{8}\left[te^{t/2}\times 2 - e^{t/2}\times 4\right]_0^t$$

$$\Rightarrow i(t)e^{t/2} = \frac{5}{4}te^{t/2} - \frac{5}{2}(e^{t/2}-1)$$

$$\Rightarrow \boxed{i(t) = \frac{5}{4}t - \frac{5}{2}(1-e^{-t/2})} \Rightarrow \boxed{i(4) = \frac{5}{2} + \frac{5}{2}e^{-2}}$$

$$\therefore V_L = L\frac{di}{dt} = 4\frac{di}{dt} = 4\left\{\frac{5}{4} - \frac{5}{4}e^{-t/2}\right\}$$

$$\therefore V_L = 5(1-e^{-t/2}) \Rightarrow \boxed{V_L(4) = 5(1-e^{-2})}$$