# CSE - 250

## Simulation Project

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Section: 06

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Methodology 1:

- Sum the student ID, to find the value of $\tau$.
- Using that we will find the equivalent resistance of the circuit.
- From there we will find $R_1$, $R_2$, $R_3$.
- Then we will draw the circuit in LTspice.

1) a) Student ID : 21301436

So, total = 2+1+3+0+1+4+3+6 = 20 ms

Given, $C = 2\mu F$

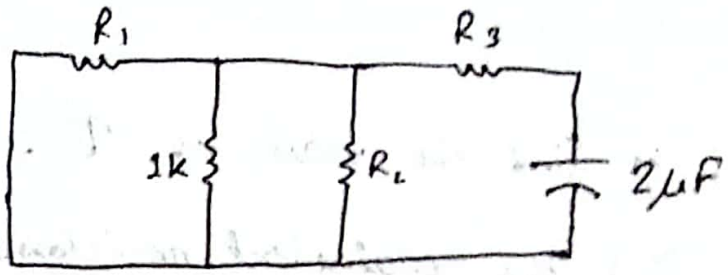
$\therefore 5\tau = 20$

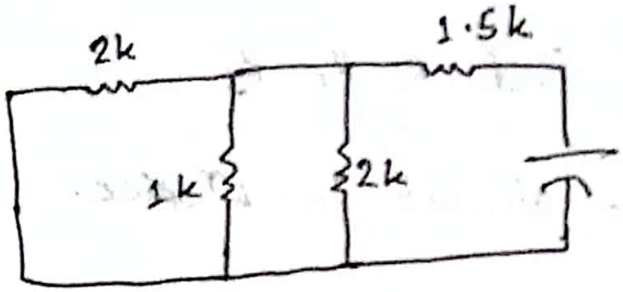
$\Rightarrow \tau = 4$

$\therefore RC = 4$

$\rightarrow R_{eq} = 4/2 = 2\,k\Omega$

P.T.O



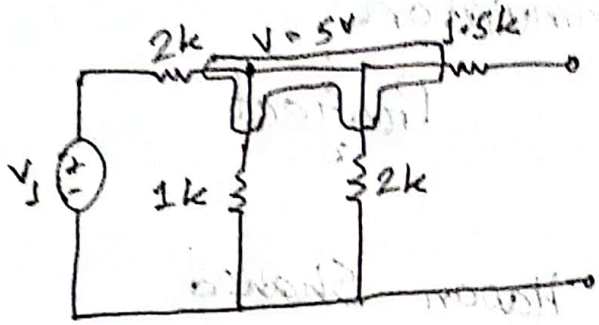

Here, $\left(\frac{1}{2} + \frac{1}{1} + \frac{1}{2}\right)^{-1} + 1.5$

$= 0.5 + 1.5$

$= 2k\Omega$

$= R_{eq.}$

b) From the graph we can see the voltage across the capacitor is 5V and -2V.



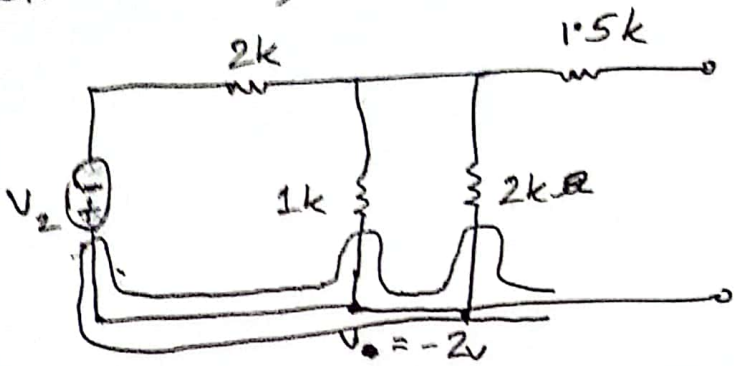

Here, V = 5V since the resistors are in parallel.

So, $\frac{5 - V_1}{2} + \frac{5}{1} + \frac{5}{2} = 0.$

$\Rightarrow \frac{5 - V_1 + 10 + 5}{2} = 0$

$\Rightarrow V_1 = 20\ V$

Again $V = -2V$,



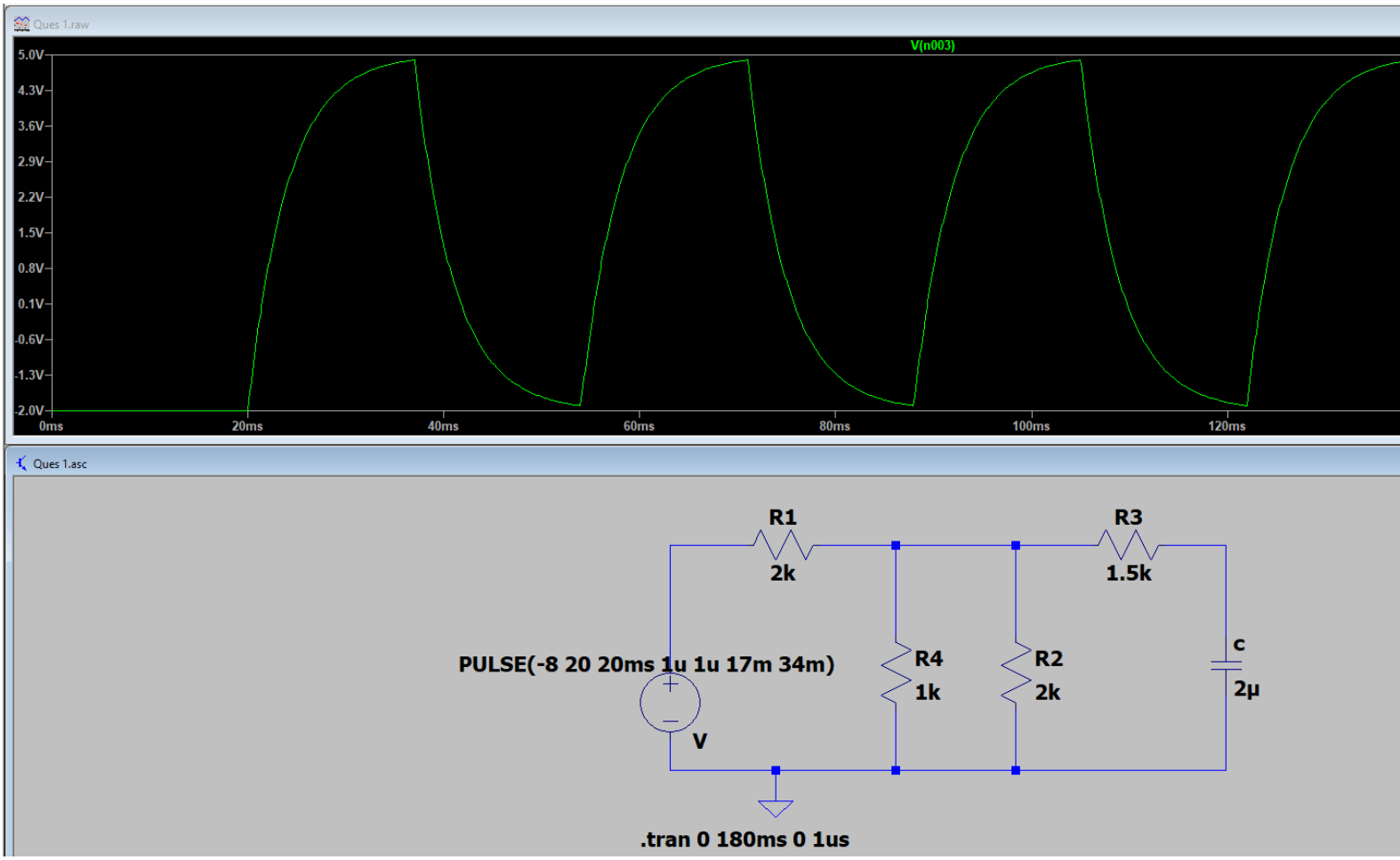

Now, $\frac{V_2 + 2}{2} + \frac{2}{1} + \frac{2}{2} = 0$

$\Rightarrow \frac{V_2 + 2 + 4 + 2}{2} = 0$

$\Rightarrow V_2 = -8V$

(Ans.)

1)c)


Ques 1.raw
V(n003)
5.0V
4.3V
3.6V
2.9V
2.2V
1.5V
0.8V
0.1V
-0.6V
-1.3V
-2.0V
0ms
20ms
40ms
60ms
80ms
100ms
120ms
Ques 1.asc
R1
2k
R3
1.5k
PULSE(-8 20 20ms 1u 1u 17m 34m)
V
R4
1k
R2
2k
C
2µ
.tran 0 180ms 0 1us

## Methodology 2:

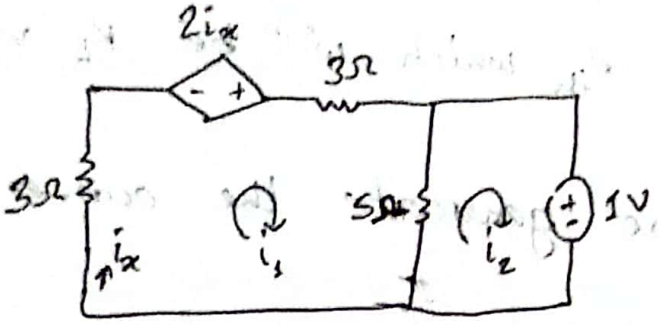
- Using the ID we get max power then solving the circuit we get $R_{th}$ which will be $R_L$ value.
- Using LTspice we generate the curve.
- By using mesh we find $I_s$.
- Then we simulate the original circuit

P.T.O

2)a) total of ID: 2 + 1 + 3 + 0 + 1 + 4 + 3 + 6

= 20 W

Now,




Applying mesh:

$$3i_1 - 2i_1 + 3i_1 + 5i_1 - 5i_2 = 0$$

$$\Rightarrow \boxed{9i_1 - 5i_2 = 0}$$

$$\boxed{5i_2 - 5i_1 = 10}$$

$$\Rightarrow i_1 = 0.25\,A$$

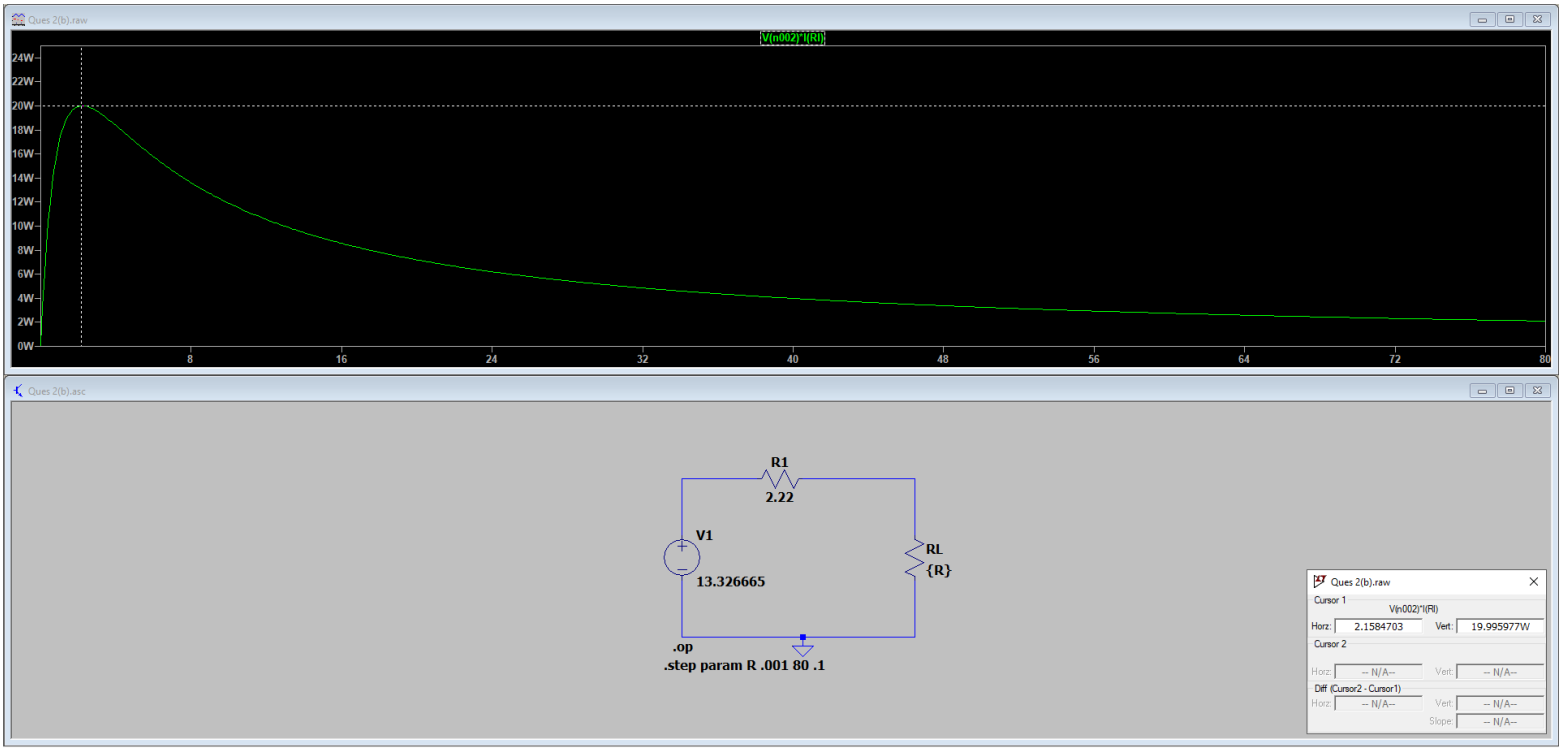
$$i_2 = 0.45\,A = i_0$$

$$\therefore R_{th} = \frac{1}{0.45} = 2.22\,\Omega$$

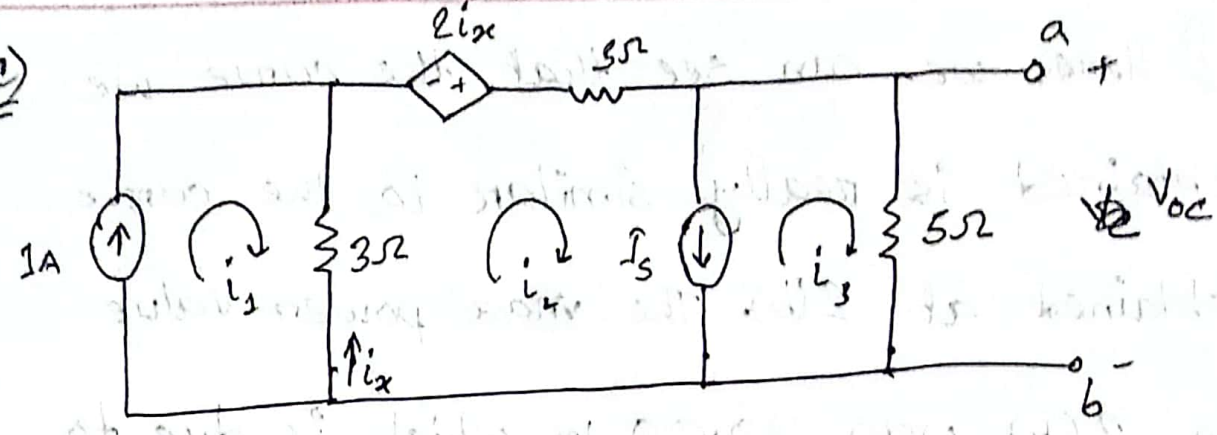
$$\therefore P_{max} = \frac{V_{th}^2}{4R_{th}}$$

$$\Rightarrow V_{th} = 13.326665\,V$$

2)b)


Ques 2(b).raw
V(n002)*I(Rl)
24W
22W
20W
18W
16W
14W
12W
10W
8W
6W
4W
2W
0W
8
16
24
32
40
48
56
64
72
80
Ques 2(b).asc
R1
2.22
V1
13.326665
RL
{R}
.op
.step param R .001 80 .1
Ques 2(b).raw
Cursor 1
V(n002)*I(Rl)
Horz: 2.1584703
Vert: 19.995977W
Cursor 2
Horz: -- N/A--
Vert: -- N/A--
Diff (Cursor2 - Cursor1)
Horz: -- N/A--
Vert: -- N/A--
Slope: -- N/A--

c)




$i_1 = 1A, \quad i_x = i_2 - i_1$

$= i_2 - 1$

$I_s = i_2 - i_3$

Applying mesh,

$-3i_2 + 3i_1 - 2(i_2 - 1) + 3i_2 + 5i_3 = 0$

$\Rightarrow 3i_2 - 3 - 2i_2 + 2 + 3i_2 + 5i_3 = 0$

$\Rightarrow 4i_2 + 5i_3 = 1 \quad \text{——} (1)$

NOW, $i_3 = \frac{V_{oc}}{R}$

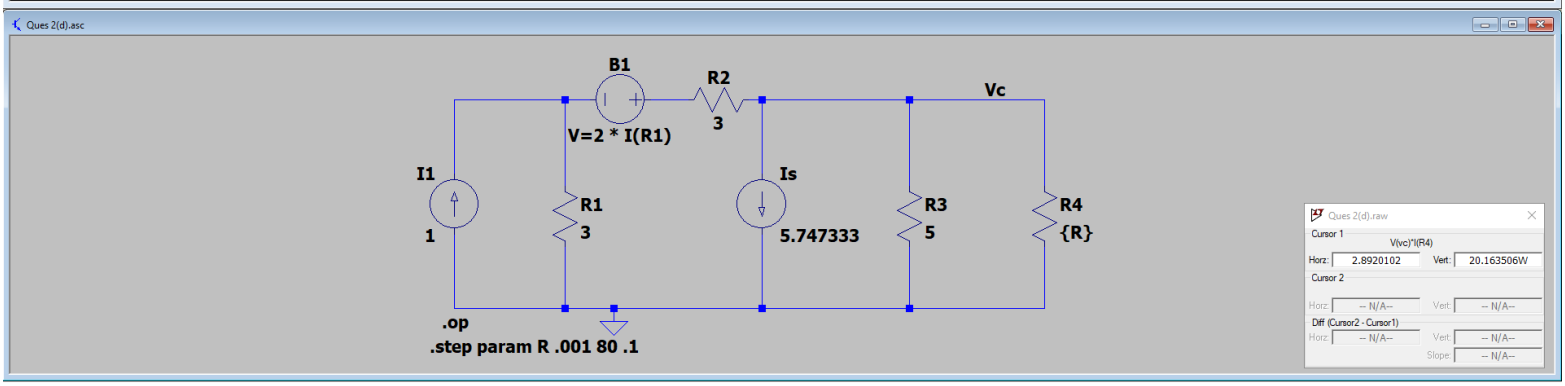
$= \frac{13.326665}{5} = 2.665333 \text{ A}$

From eqn (1), $i_2 = -3.082 \text{ A}$

$\therefore I_s = -5.747333 \text{ A}$

d) Here; we can see that the curve we obtained is really similar to the curve obtained at 2(b). The max power value in 2(b) was 10.09 W which is due to the rounding up during the calculation of the thevenin circuit. But in part d we got a pretty accurate answer of 20.16 W. So, the curve derived in ~~pad~~ part b and d are same.


Ques 2(d).raw
V(vc)*I(R4)
22W
20W
18W
16W
14W
12W
10W
8W
6W
4W
2W
0W
8
16
24
32
40
48
56
64
72
80


Ques 2(d).asc
B1
R2
3
Vc
V=2 * I(R1)
I1
1
R1
3
Is
5.747333
R3
5
R4
{R}
.op
.step param R .001 80 .1
Ques 2(d).raw
Cursor 1
V(vc)*I(R4)
Horz: 2.8920102
Vert: 20.163506W
Cursor 2
Horz: -- N/A--
Vert: -- N/A--
Diff (Cursor2 - Cursor1)
Horz: -- N/A--
Vert: -- N/A--
Slope: -- N/A--