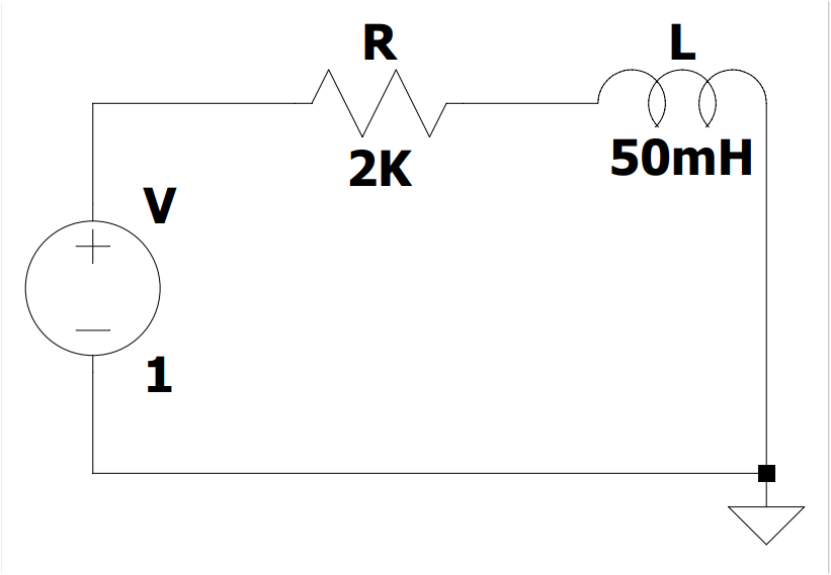
RL Circuit :

Plot i(t), V_R(t) and V_L(t) for the given RL series circuit using Pspice.



CODE:

Series RL Circuit

V 1 0 DC 1

R 1 2 2K

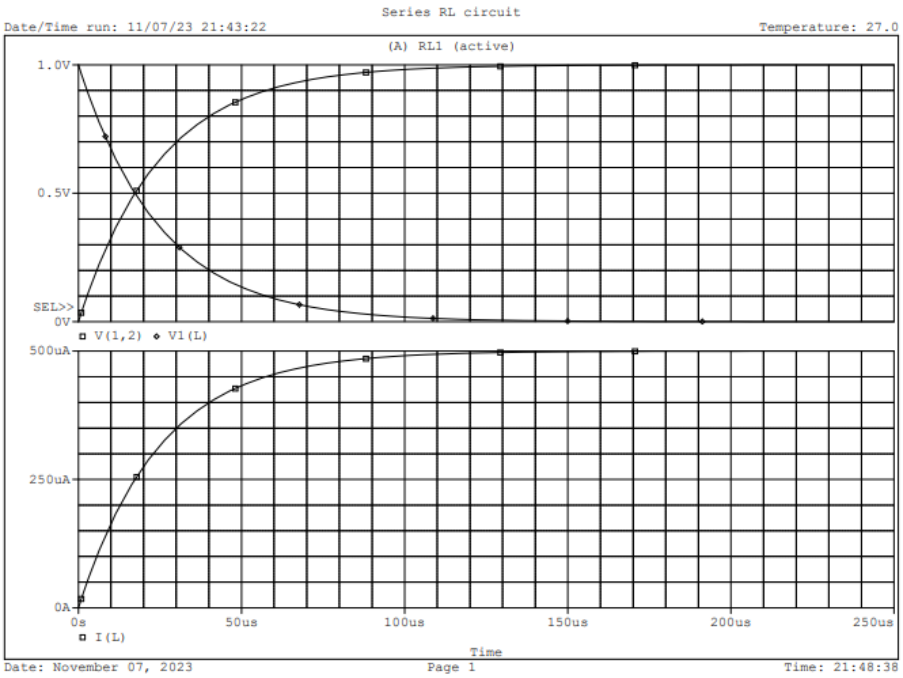
L 2 0 50m

.TRAN 2.5u 250u UIC

.PROBE

.END

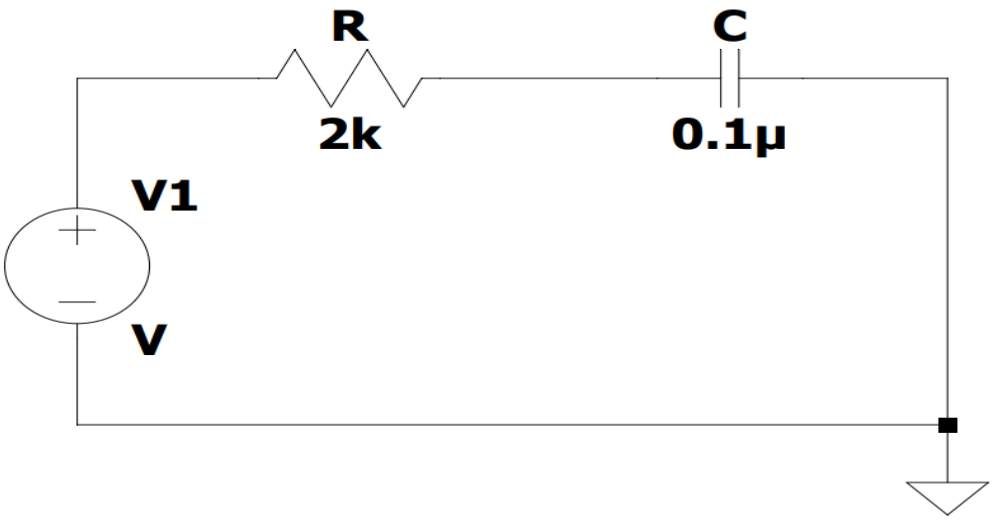
Output Plot:



$V_R(t)$, $V_L(t)$ and $I_L(t)$ plots for series RC circuit

RC Circuit :

Plot i(t), V_R(t) and V_C(t) for the given RL series circuit using Pspice.



CODE:

Series RC Circuit

V 1 0 DC 5

R 1 2 2K

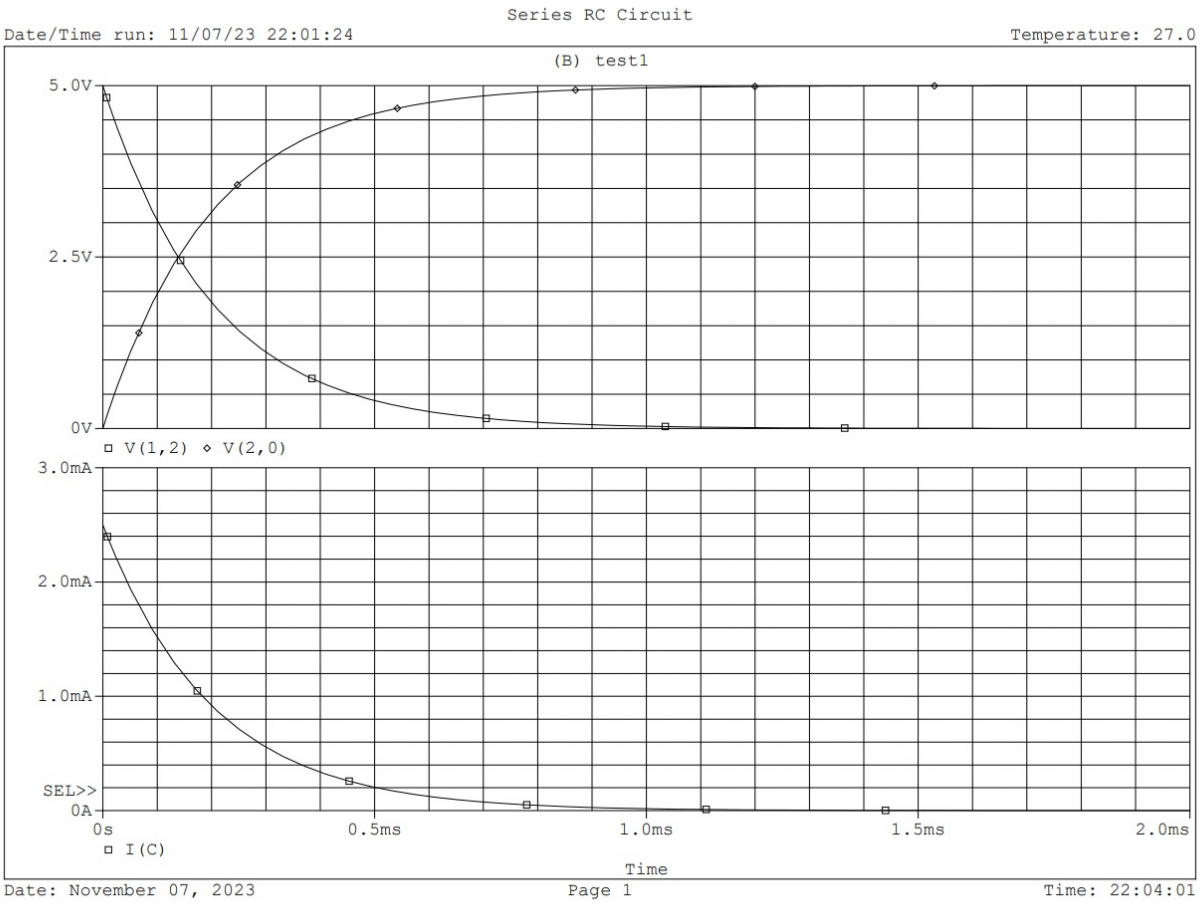
C 2 0 0.1u

.TRAN 0.02m 2m UIC

.PROBE

.END

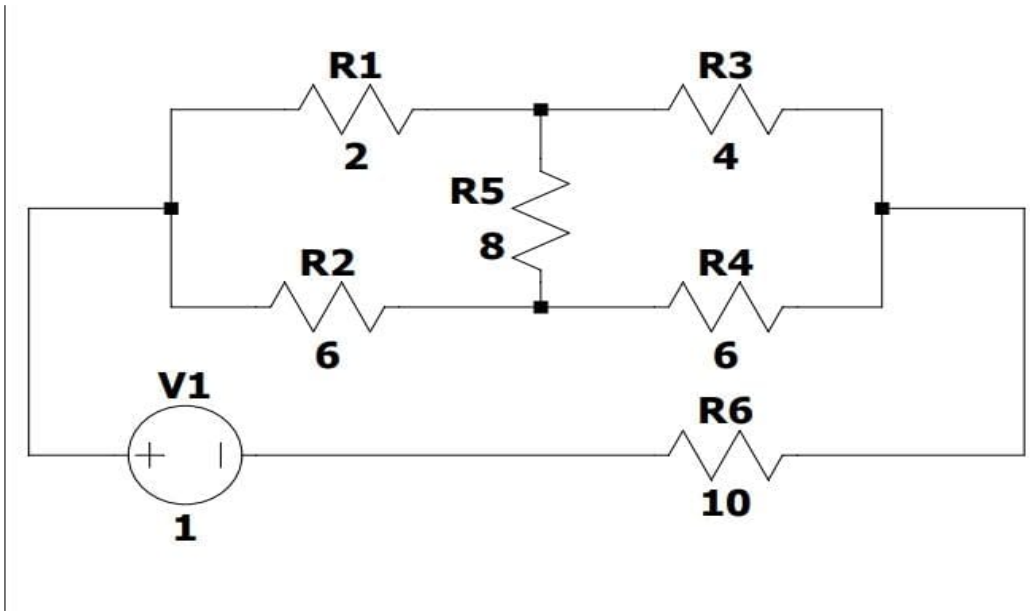
Output Plot:



$V_R(t)$, $V_C(t)$ and $I_C(t)$ plots for series RC circuit

Thevenin Theorem:

Find out Thevenin Equivalent Circuit and find out V_{th} and R_{th} Using Pspice for the given circuit.



Case 1: Calculation of V_{th}

CODE

```
Calculation of V
V1 1 0 DC 1
R1 1 2 2

R2 2 4 4

R3 1 3 6

R4 3 4 6

R5 4 0 10

.OP

.END
```

6

OUTPUT

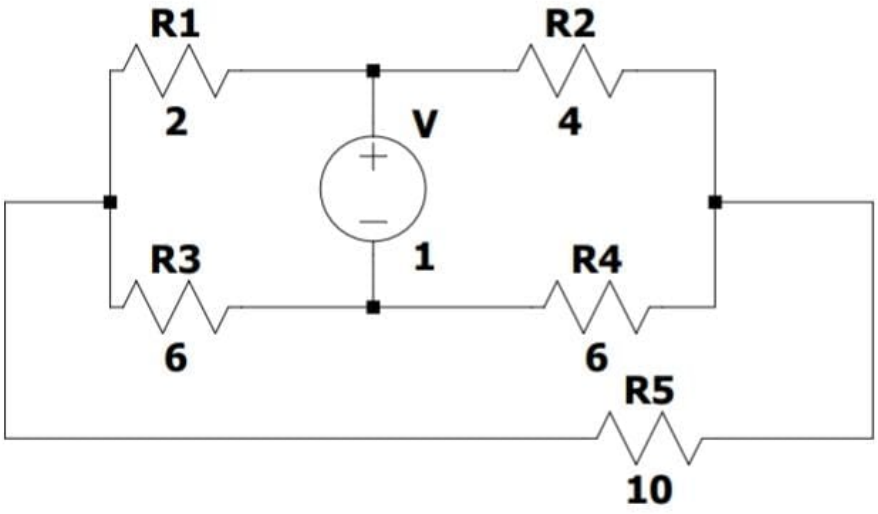
NODE	*VOLTAGE*	*NODE*	*VOLTAGE*	*NODE*	*VOLTAGE*	*NODE*	*VOLTAGE*
1	1.0000	2	.9048	3	.8571	4	.7143

VOLTAGE SOURCE CURRENTS

NAME	*CURRENT*
V1	-7.143E-02

V_{th} = V(2) – V(3) = 0.0477 V

Case 2: Calculation R_{th}



CODE

Calculation of R

V 1 2 DC 1

R1 0 1 2

6

```
7
R2 1 3 4
R3 0 2 6
R4 2 3 6
R5 3 0 10
.OP
.END
```

OUTPUT

VOLTAGE SOURCE CURRENTS

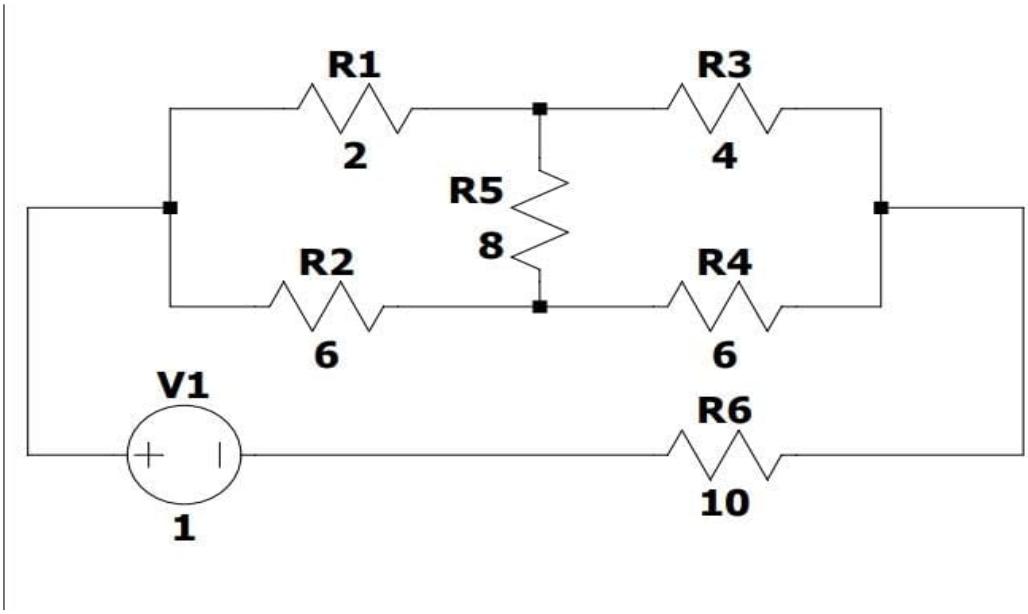
NAME	CURRENT
V	2.266E 00

R_{th} **= 1/ 2.266 ohm**

= 4.41 ohm

Reciprocity Theorem:

Find out the current through the 8 ohm resistor in the given circuit using P-spice and verify reciprocity theorem.



STEP-1

Finding out the current through 8 ohm resistor

CODE:

DC Analysis
V1 0 1 DC 1
V2 4 3 DC 0
R1 1 2 2
R2 2 5 4
R3 2 3 8
R4 1 4 6
R5 4 5 6
R6 5 0 10

```
.op
.end
```

OUTPUT:

```
VOLTAGE SOURCE CURRENTS
  NAME        CURRENT
    V2          3.836E-03
```

STEP-2

Finding out the current through 8 ohm resistor

CODE:

```
DC Analysis
V2 0 1 DC 0
V1 4 3 DC 1
R1 1 2 2
R2 2 5 4
R3 2 3 8
R4 1 4 6
R5 4 5 6
R6 5 0 10
.op
.end
```

OUTPUT:

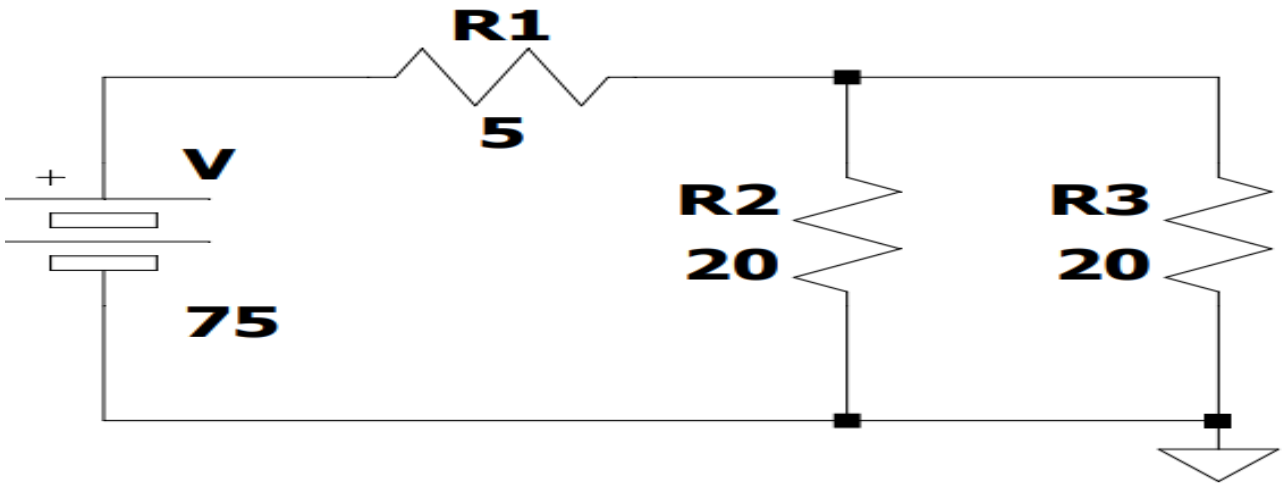
```
VOLTAGE SOURCE CURRENTS

 NAME        CURRENT
   V1          3.836E-03
```

Here, from the produced output we can notice that the current passing through $V_{2,}$ after swapping the sources, is equal to the current passing through V_1. Hence, the Reciprocity theorem is proved and the value of current passing through 8 ohm resistor is 3.836 mA

Compensation Theorem:

Verify compensation theorem using PSpice for the given circuit when the value of R_L is increased by 30%.

Case 1: When R3 is 20ohm.



Case- 1: When R3 is 20 ohm.

CODE

With given R value

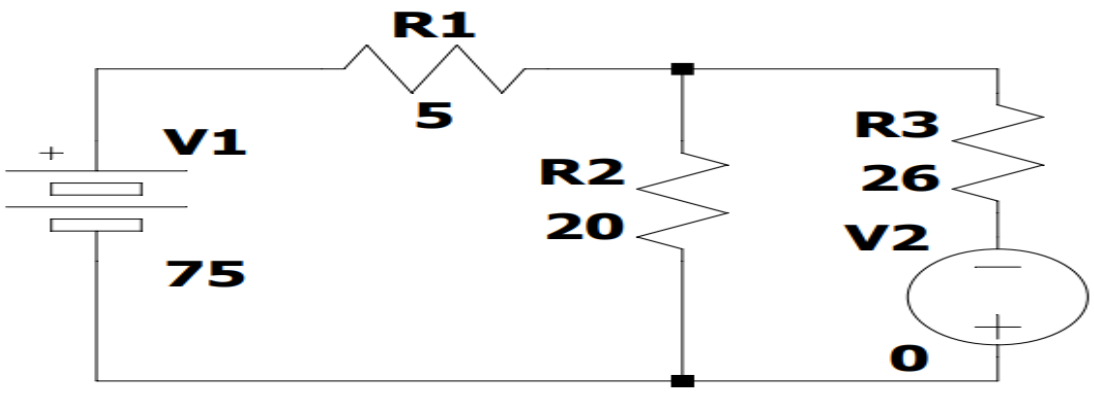
```
V1 1 0 DC 75
V2 3 0 DC 0
R1 1 2 5
R2 2 0 20
R3 2 3 20
.OP
.END
```

OUTPUT

VOLTAGE SOURCE CURRENT

NAME	CURRENT
V1	-5.000E+00
V2	2.500E+00

Case- 2: When R3 is 26 ohm.



CODE

R value increased

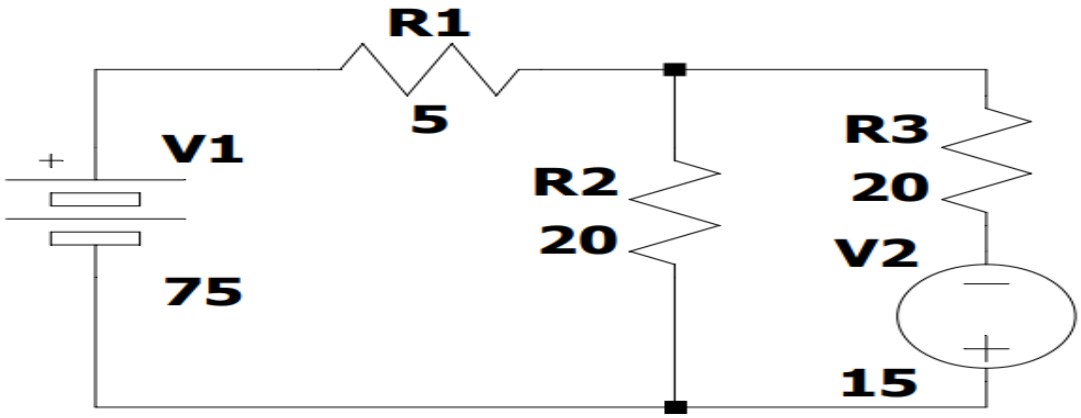
```
V1 1 0 DC 75
V2 3 0 DC 0
R1 1 2 5
R2 2 0 20
R3 2 3 26
.OP
.END
```

OUTPUT

VOLTAGE SOURCE CURRENTS

NAME	CURRENT
V1	-4.600E+00
V2	2.000E+00

Case-3: When voltage source is added



CODE

Compensated circuit

```
V1 1 0 DC 75
V2 3 0 DC –15
R1 1 2 5
R2 2 0 20
R3 2 3 26
.OP
.END
```

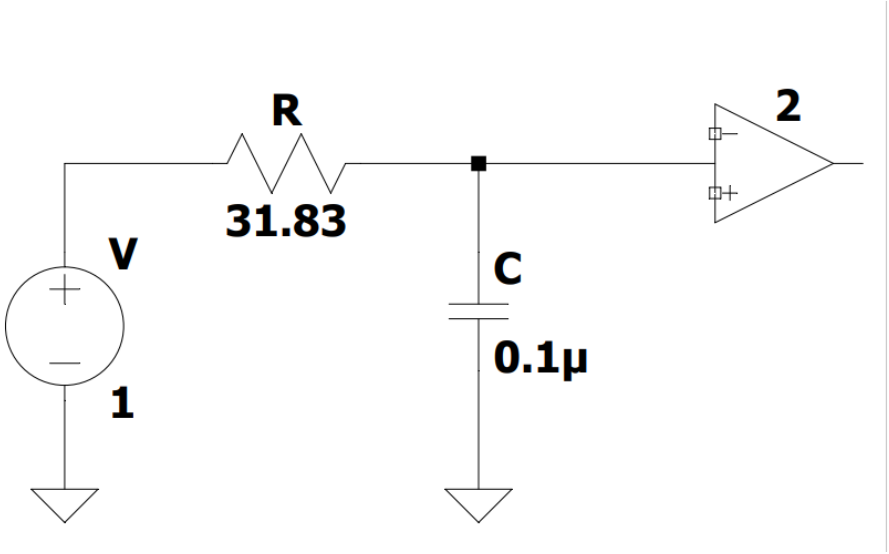
OUTPUT

VOLTAGE SOURCE CURRENTS

NAME	CURRENT
V1	-5.000E+00
V2	2.500E+00

Active Lowpass Filter:

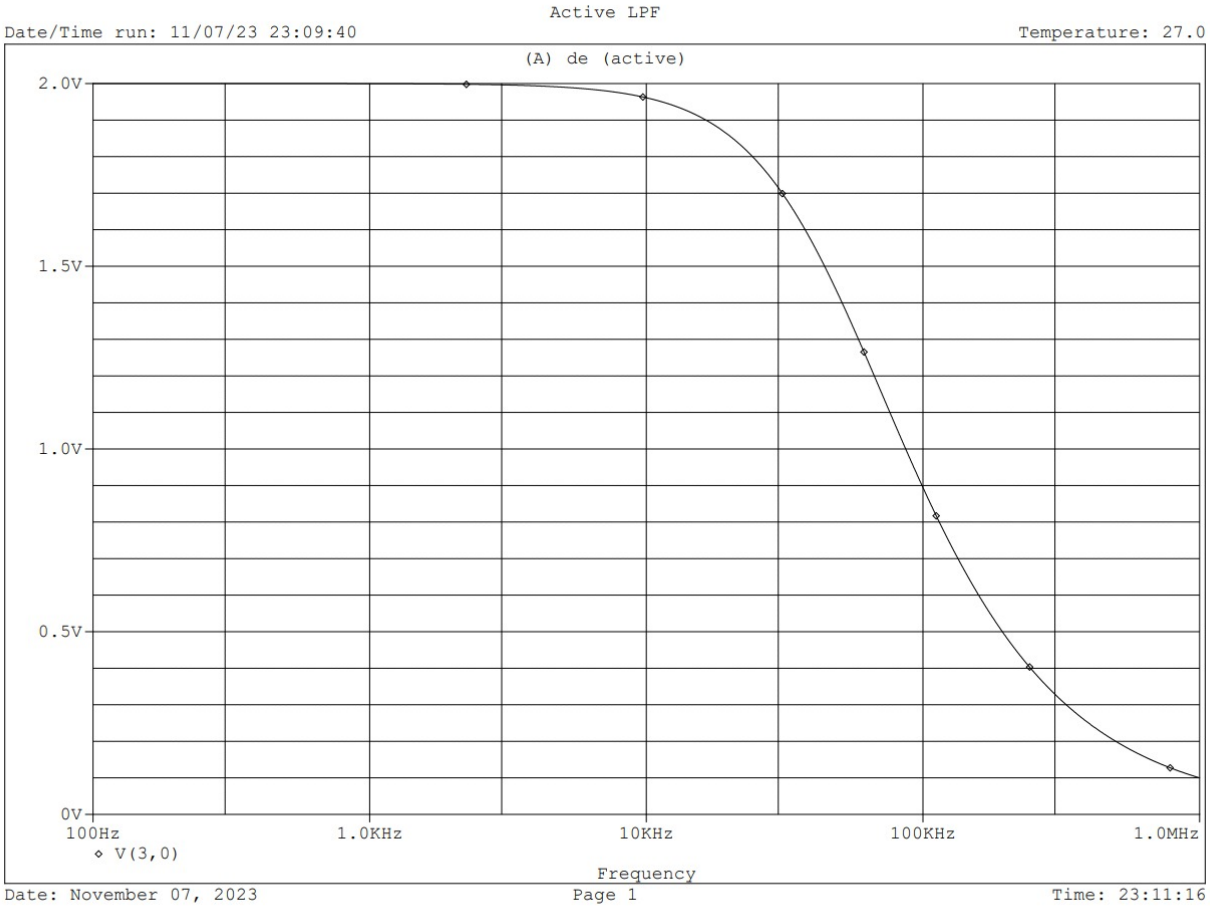
Design a 1st order low-pass filter with cutoff frequency 50kHz and voltage gain 2. Plot the frequency response using P-Spice.



CODE:

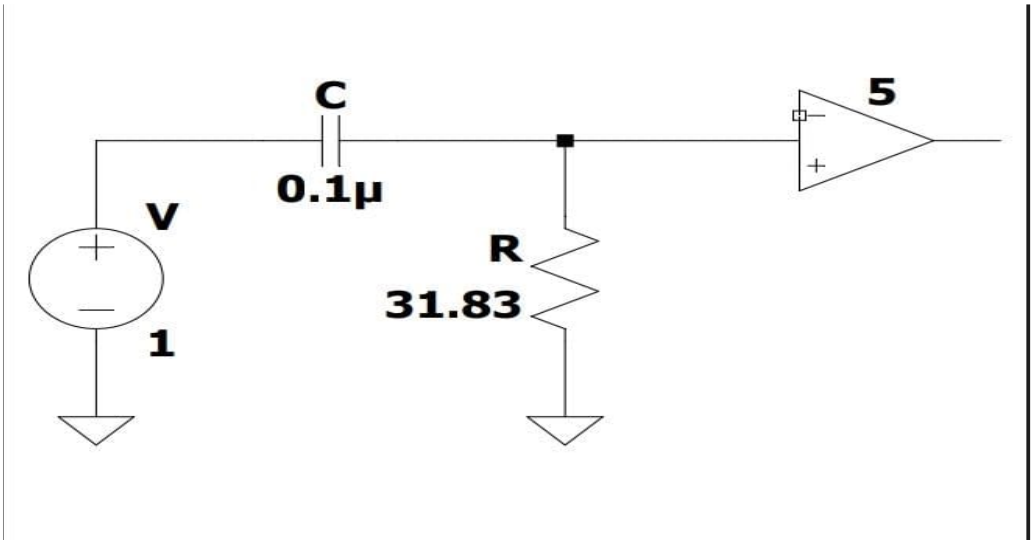
Active LPF
V 1 0 AC 1
R 1 2 31.83
C 2 0 0.1u
E 3 0 2 0 2
.ac dec 1000 100Hz 1000kHz
.PROBE V_M(3,0) V_M(1,0)
.END

Output Plot:


Active LPF
Date/Time run: 11/07/23 23:09:40
Temperature: 27.0
(A) de (active)
2.0V
1.5V
1.0V
0.5V
0V
100Hz
1.0KHz
10KHz
100KHz
1.0MHz
V(3,0)
Frequency
Date: November 07, 2023
Page 1
Time: 23:11:16

Active Highpass Filter:

Design a first order high pass filter with cutoff frequency 5KHz and voltage gain of 5. Plot the frequency response using Pspice.



CODE:

Active HPF

V 1 0 ac 1

C 1 2 0.1u

R 2 0 318.3

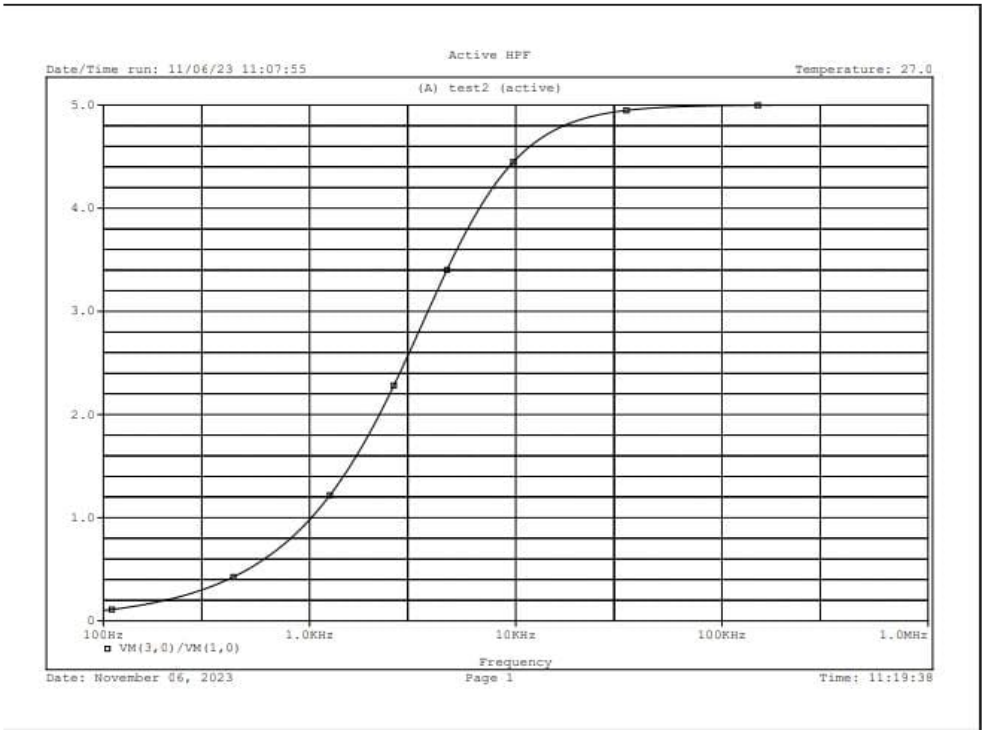
E 3 0 2 0 5

.ac dec 1000 100Hz 1000KHz

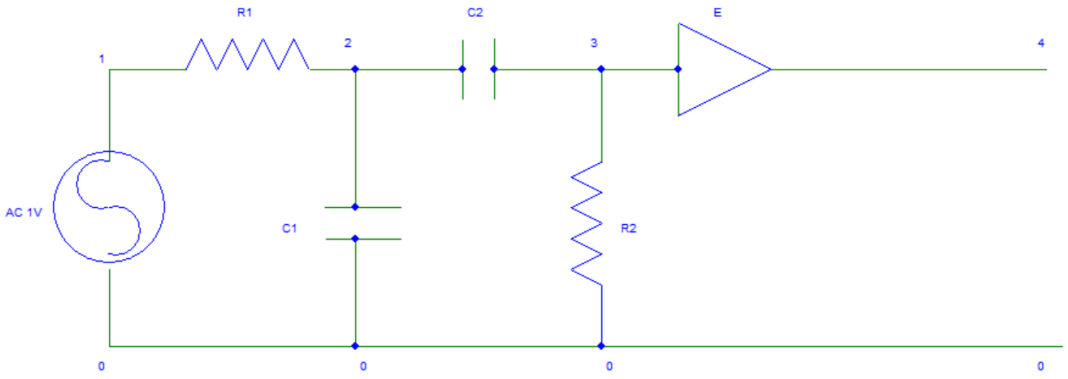
.PROBE V_M(3,0) V_M(1,0)

.END

Output Plot:


Active HPF
Date/Time run: 11/06/23 11:07:55
Temperature: 27.0
(A) test2 (active)
5.0
4.0
3.0
2.0
1.0
0
100Hz
1.0KHz
10KHz
100KHz
1.0MHz
VM(3,0)/VM(1,0)
Frequency
Date: November 06, 2023
Page 1
Time: 11:19:38

Active Bandpass Filter:



Band Pass Filter

V 1 0 AC 1

R1 1 2 318.3

C1 2 0 0.1u

C2 2 3 0.1u

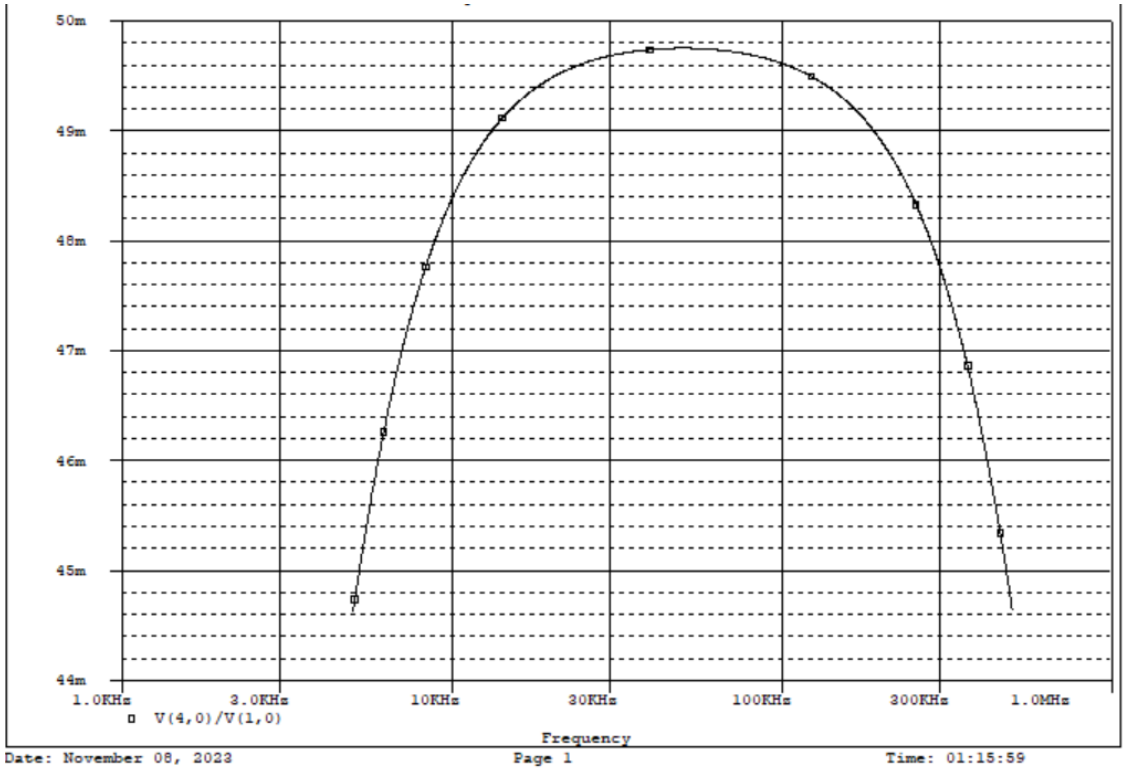
R2 3 0 3.183

E 4 0 3 0 10

.ac dec 1000 5kHz 500kHz

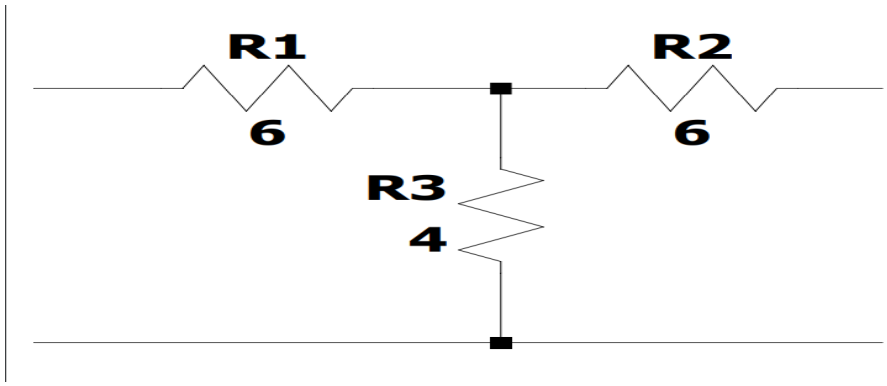
.probe $V_M(4,0)$ $V_M(1,0)$

.end

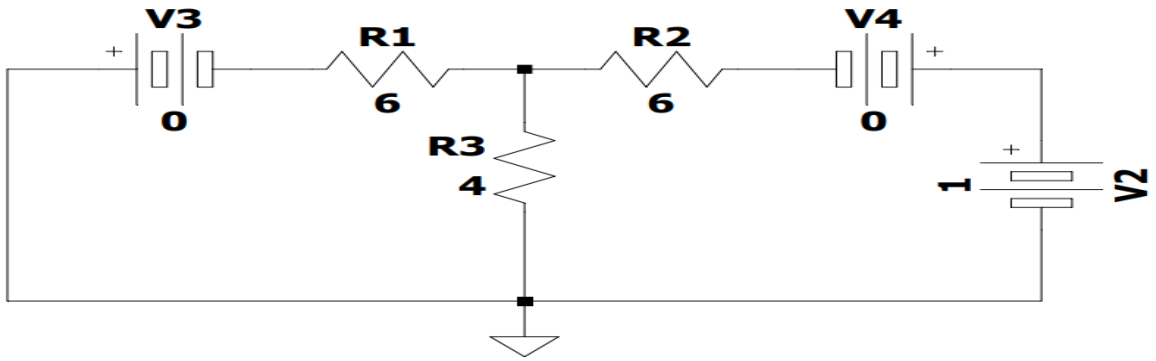

50m
49m
48m
47m
46m
45m
44m
1.0KHz
3.0KHz
10KHz
30KHz
100KHz
300KHz
1.0MHz
V(4,0)/V(1,0)
Frequency
Date: November 08, 2023
Page 1
Time: 01:15:59

Y-parameter:

Find out the Y-parameters for the given circuit using Pspice.



Case-1: When $V_1 = 0$.



CODE:

V1 4 0 DC 1

V2 0 1 DC 0

V3 4 3 DC 0

R1 1 2 6

R2 2 3 6

R3 2 0 4

.OP

.END

OUTPUT:

Voltage source currents,

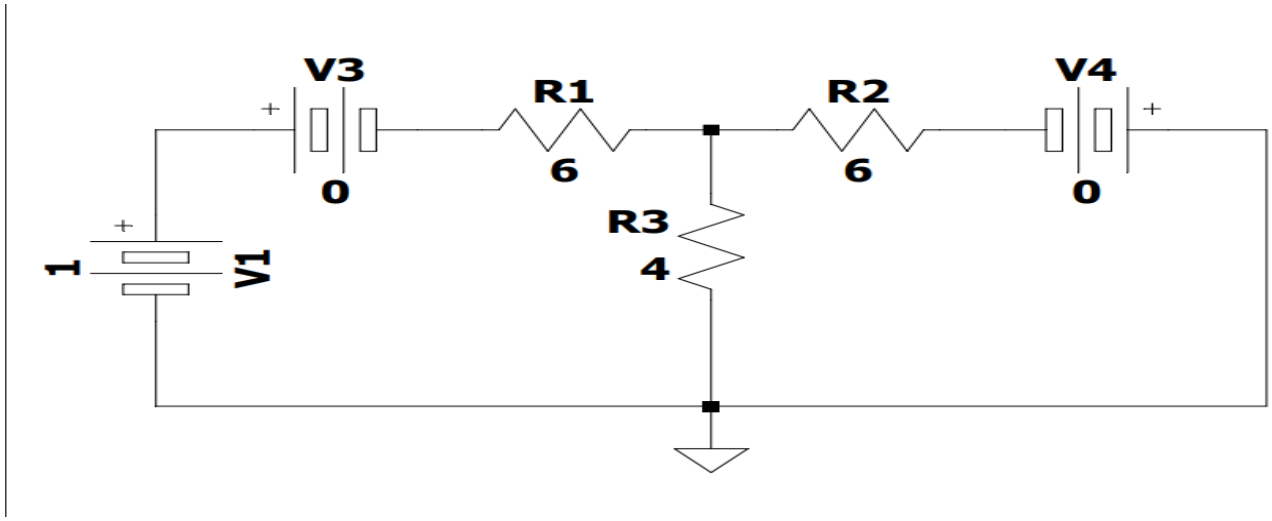
SOURCE	CURRENT
V2	-0.0476 A
V3	0.119 A

Now,

$$Y_{12} = \frac{I_1}{V_2} = \frac{-0.0476}{1} = -\ 0.0476$$

$$Y_{22} = \frac{I_2}{V_2} = \frac{0.119}{1} = 0.119$$

Case-2: When $V_2 = 0$.



CODE:

V1 0 1 DC 1

V2 1 2 DC 0

V3 4 0 DC 0

R1 2 3 6

R2 3 4 6

R3 3 0 4

.OP

.END

OUTPUT:

Voltage source currents,

SOURCE	CURRENT
V2	0.119 A
V3	-0.0476 A

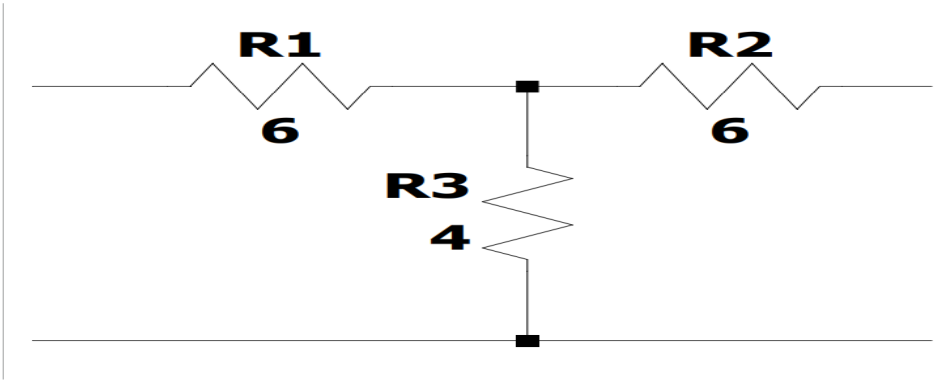
Now,

$$Y_{11} = \frac{I_1}{V_1} = \frac{0.119}{1} = 0.119$$

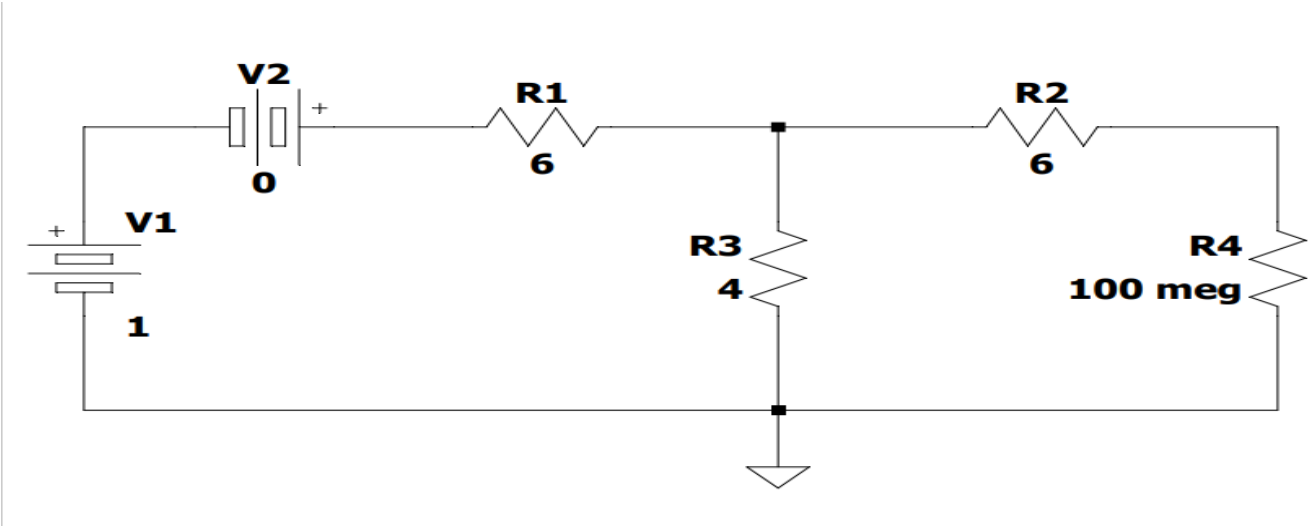
$$Y_{21} = \frac{I_2}{V_1} = \frac{-0.0476}{1} = -0.0476$$

Z-parameter:

Find out the Z-parameters for the given circuit using Pspice.



Case-1: When $I_1 = 0$



CODE:

V1 1 0 DC 1

V3 1 2 DC 0

R1 2 3 6

R2 3 4 6

R3 3 0 4

R4 4 0 100meg

.OP

.END

OUTPUT:

Voltage source currents,

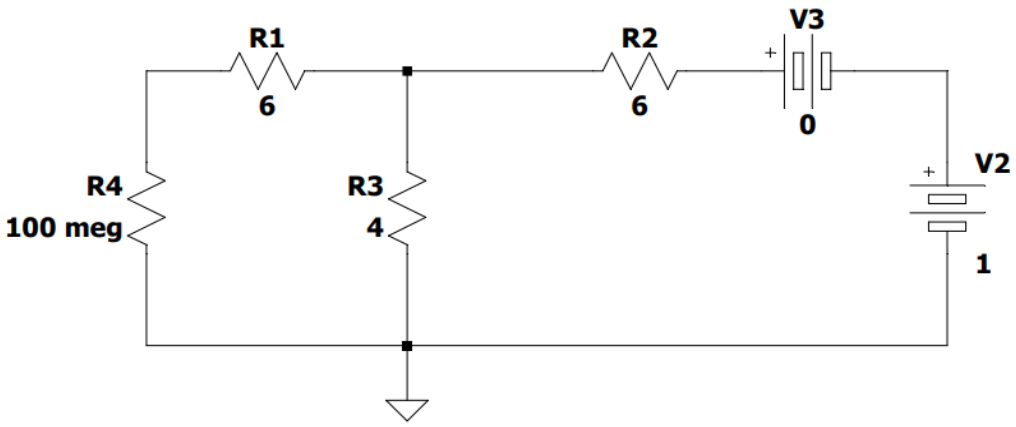
SOURCE	CURRENT
V1	0.25
V3	0.1

Now,

Z_{11} = 4 ohm

Z_{12} = 10 ohm

Case-2: When I_1 = 0,



CODE:

V1 1 0 DC 1

V3 1 2 DC 0

R1 1 2 6

R2 2 3 6

R3 2 0 4

R4 1 0 100meg

.OP

.END

OUTPUT:

Voltage source currents,

SOURCE	CURRENT
V2	0.25
V3	0.1

Now,

Z_{22} = 4 ohm

Z_{21} = 10 ohm