ASSIGNMENT NO : **01**

CMOS DIGITAL VLSI LAB
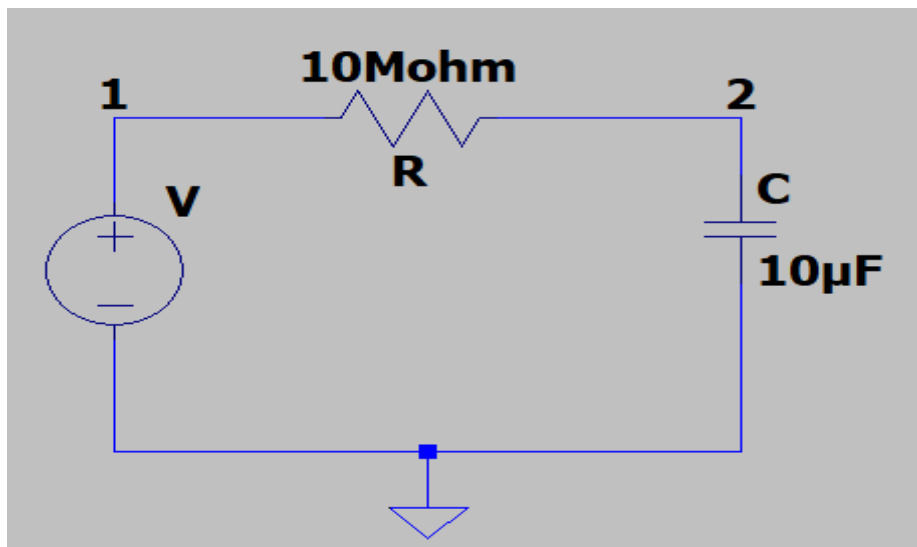
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ENROLLMENT NO/ROLL NO : **MT21MVD014**

DATE OF SUBMISSION :**15/09/2021**

QUESTION – RC circuit DC analysis

Circuit -

CODE –

```
*RC circuit dc analysis

V 1 0 5v

R 1 2 10M

C 2 0 10u ic=0

.control

dc Vs -4 4 0.1

run

plot  v(2)

plot  v(1,2)

plot i(v)

.endc

.end
```

OUTPUT –
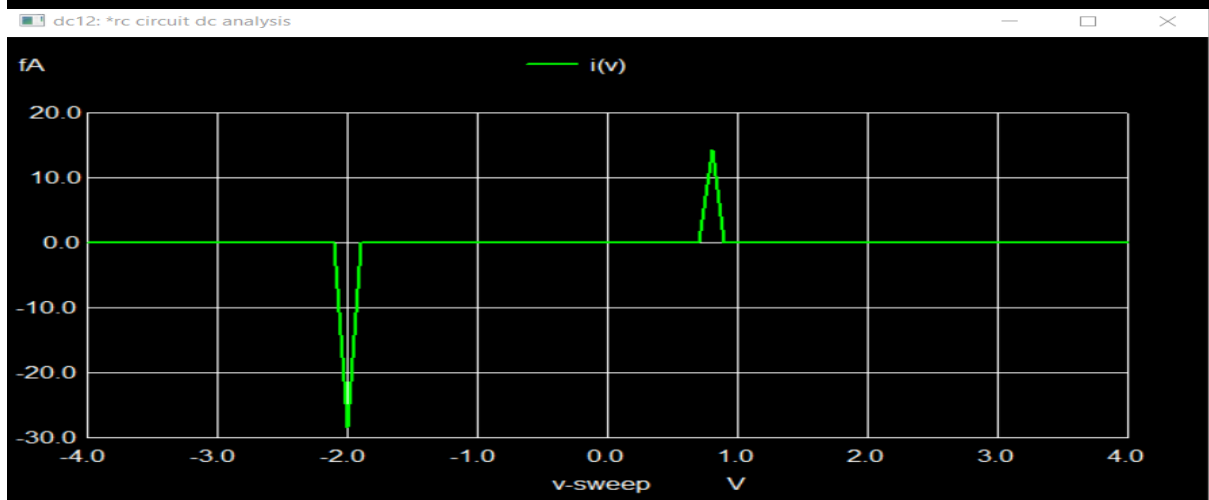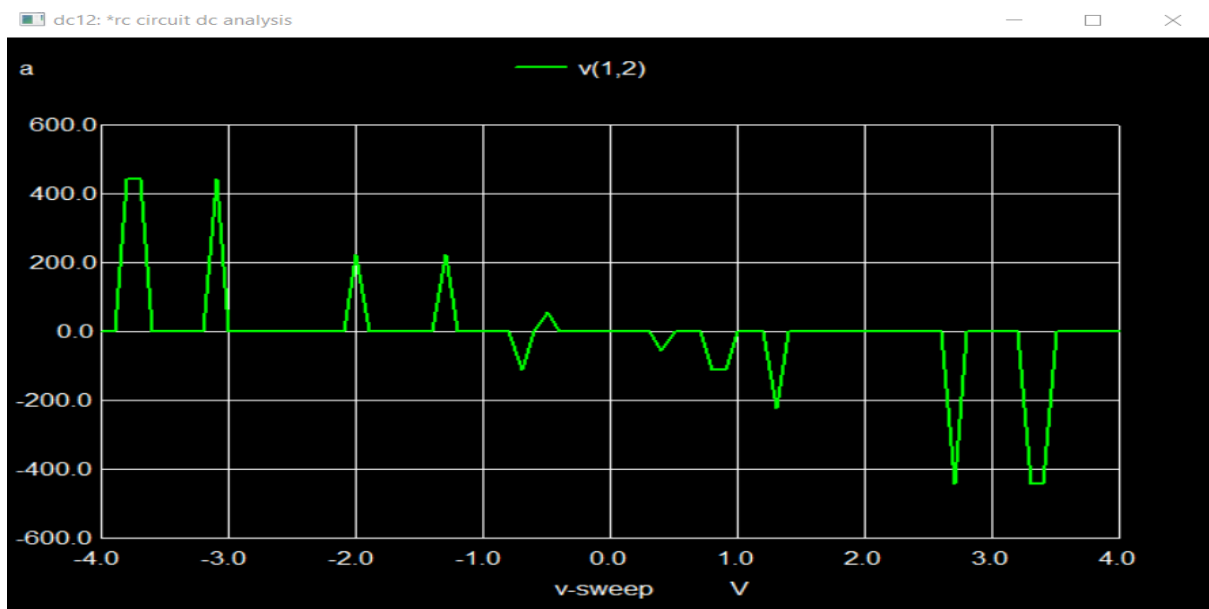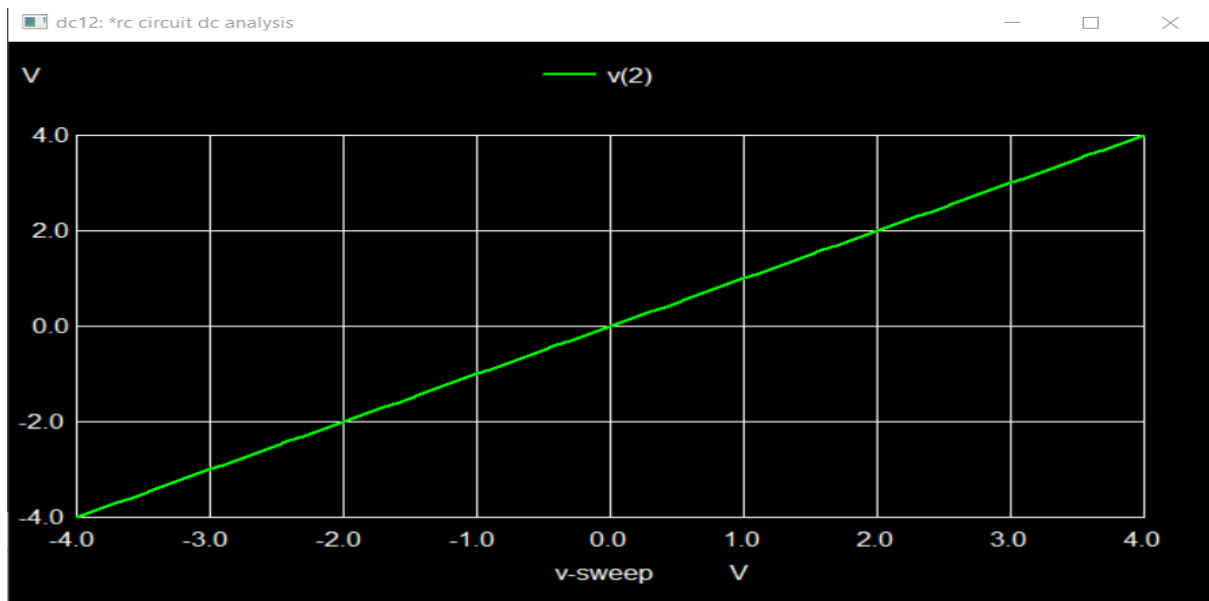
CONCLUSION –

In the above DC analysis of RC circuit, the output for V2 across the capacitor is observed which shows a linear response and output across resistance is plotted and a very less current is flowing through the circuit .

Question – RC circuit AC analysis

Code –

*Simple RC circuit AC Analysis

R 1 2 10Meg

C 2 0 10pf

Vin 1 0 ac 1

.ac dec 10 0.1 10Meg

.control

run

plot vdb(2)
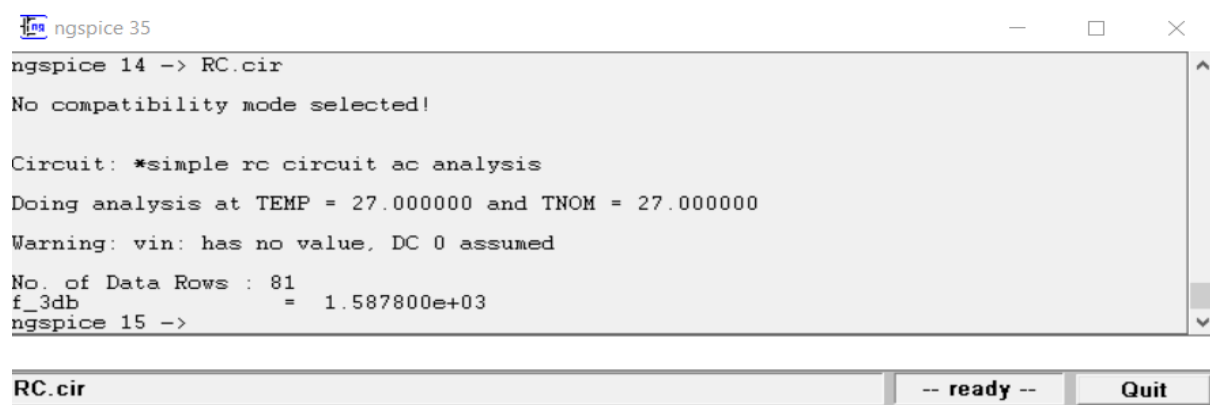
plot vp(2)

meas ac f_3db When vdb(2)=-3 cross=last

.endc

.end

Output – 3 dB frequency = 1.587800e+03 Hz

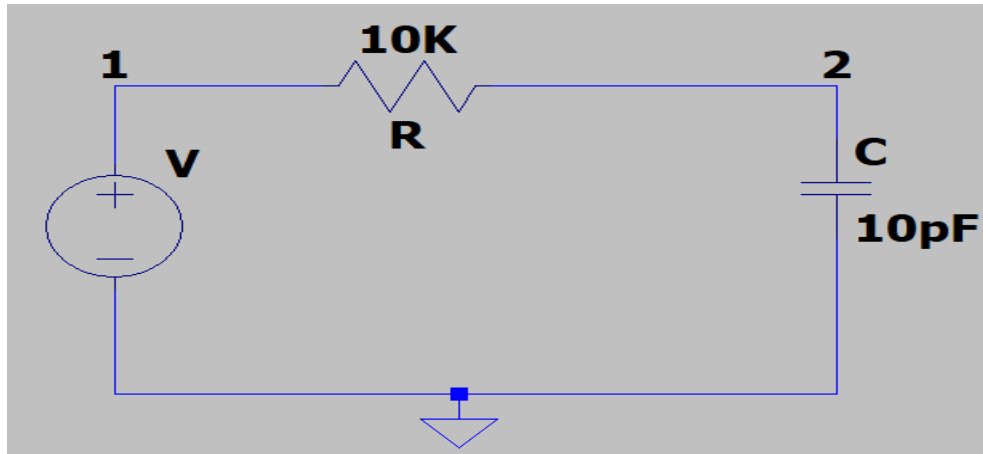**Conclusion –**

From the above AC analysis of RC circuit, I observed the frequency response across the capacitor as magnitude plot and phase plot in which i found the cut-off frequency as 1587.8 Hz

Question – RC circuit Transient Analysis

Circuit –

Code –

```
R 1 2 10k

C 2 gnd 10p

V 1 gnd dc 0 pulse(0 1 1u 1p 1p 2u 1)

.tran 2ns 5us

.control

run

plot v(1)

plot v(2)

plot v(1,2)

plot i(v)

meas tran Rise_time trig v(2) val=0.1 rise=1 targ v(2) val=0.9 rise=1

print Rise_time

meas tran Fall_time trig v(2) val=0.9 fall=1 targ v(2) val=0.9 fall=1

print Fall_time

.endc

.end
```
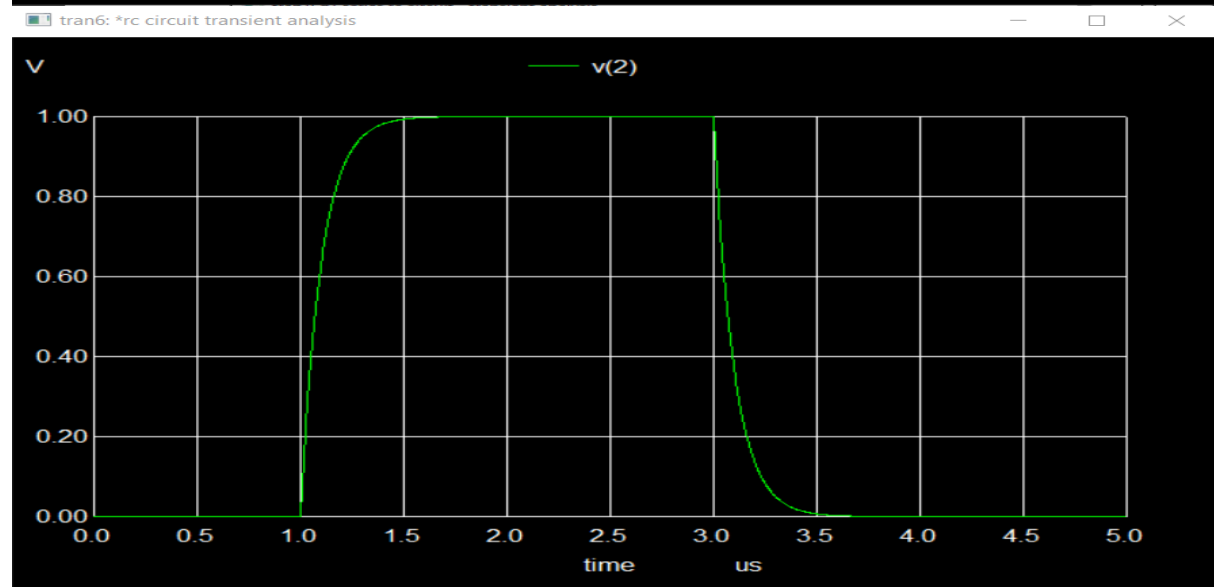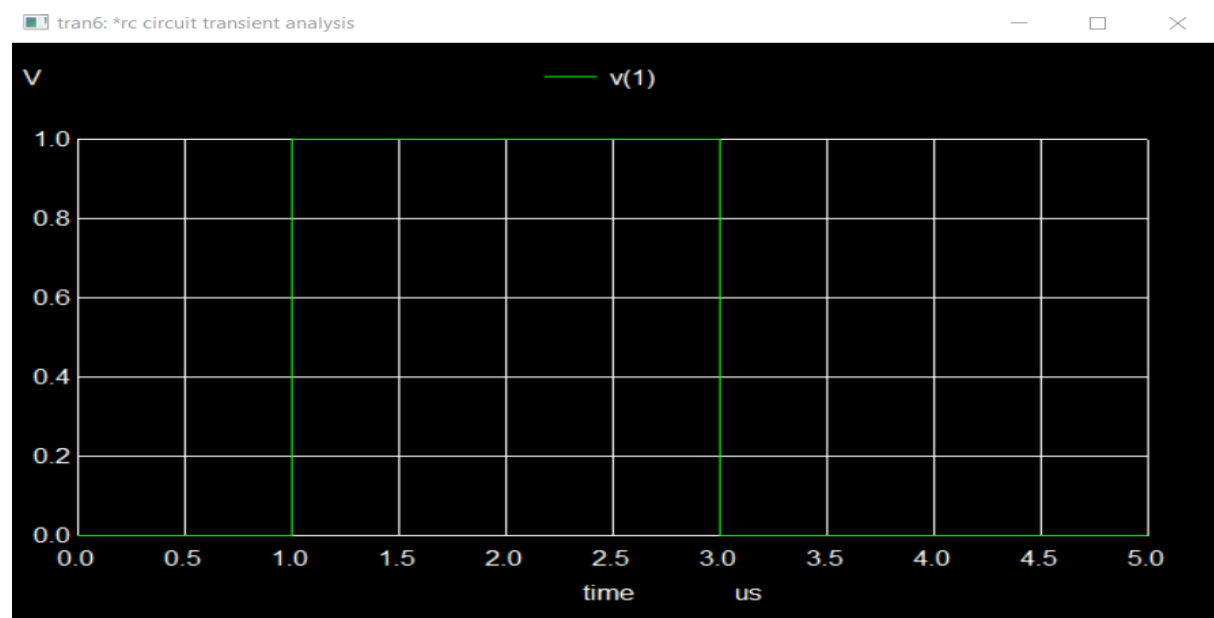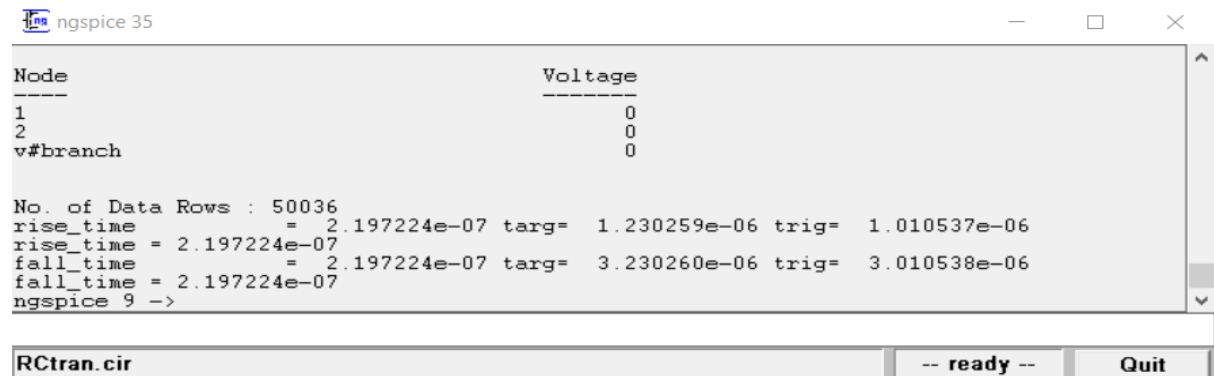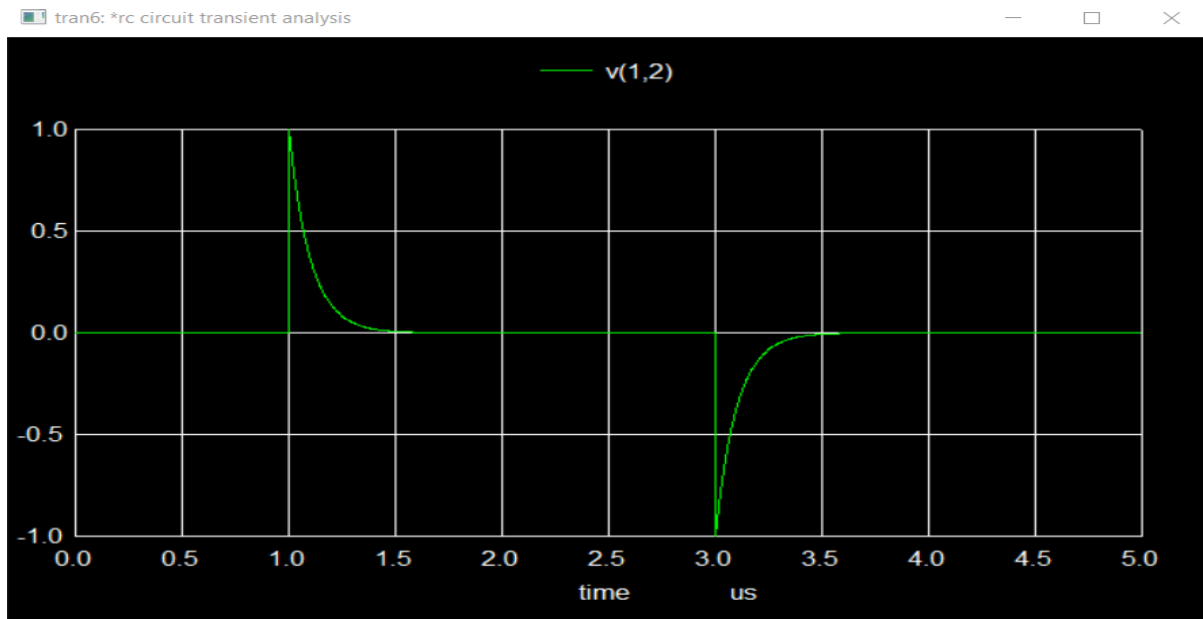
Output –

Rise time = 2.197224e-07 s

Fall time = 2.197224e-07 s

Conclusion – From the above AC transient analysis,

- I plotted the transient response across the capacitor and found the value of **rise time** & **fall time** about **0.22uSec .**
- In ac analysis of RC circuit, magnitude response and phase response across the capacitor is plotted in which the cut-off frequency(3 dB) measured as 1587.8Hz .

Q (2). For simple RLC series circuit

Question – DC analysis of RLC series circuit

Circuit –
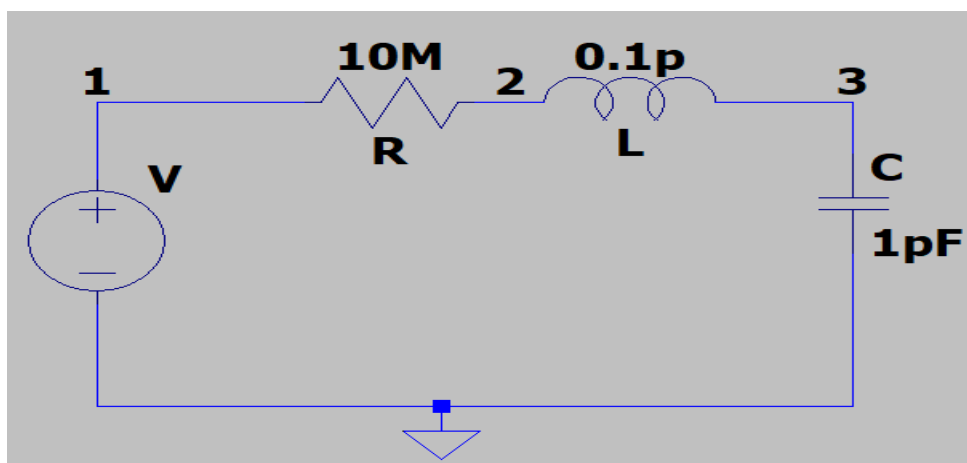
Code –

*Simple RLC circuit DC Analysis

R 1 2 10Meg

L 2 3 0.1p

C 3 0 1p

Vin 1 0 dc 0

.dc vin -5 5 0.1

.control

run

plot v(3)

plot v(1,2)

plot i(vin)

.endc

.end

Output –

dc9: *simple rc circuit transient analysis

a

v(1,2)

dc9: *simple rc circuit transient analysis

x10^-24 A

i(vin)
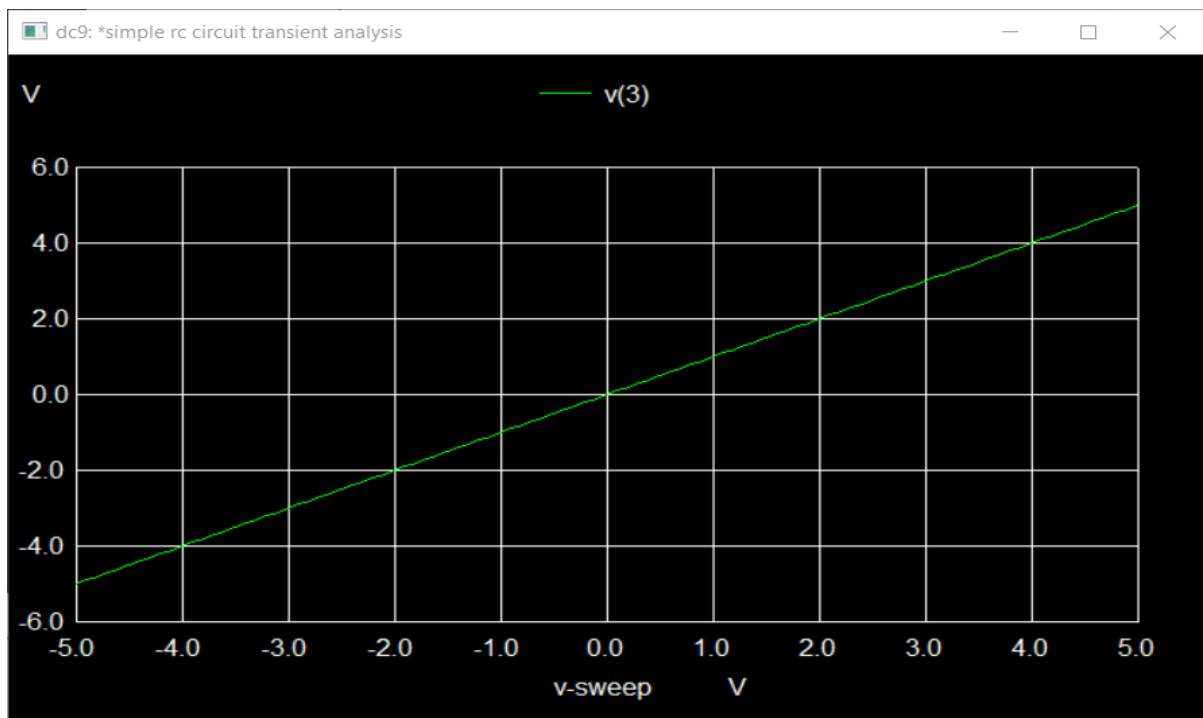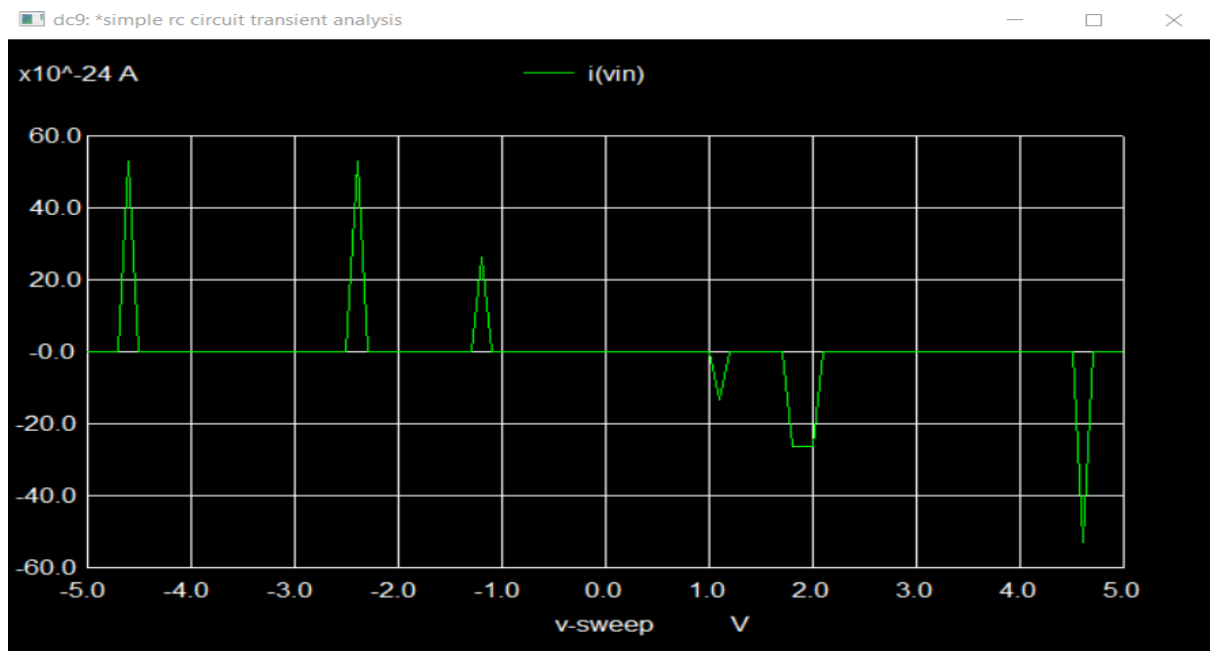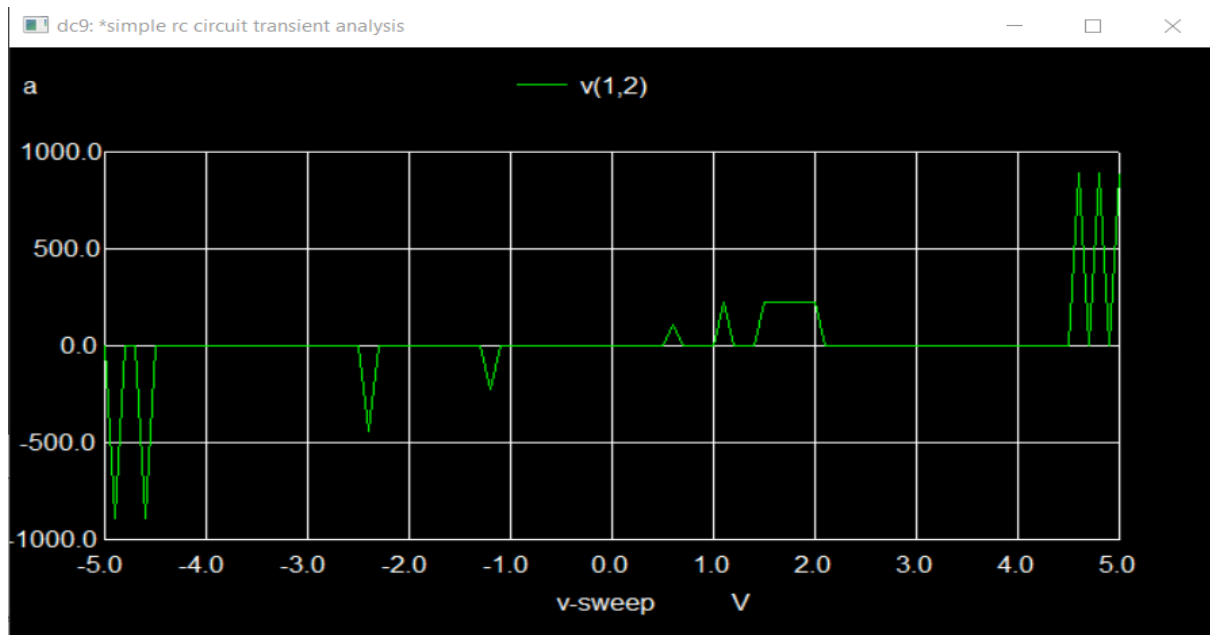
Question – AC analysis of RLC series circuit

Code –

*Simple RLC circuit AC Analysis

R 1 2 10Meg

L 2 3 0.1p

C 3 0 1p

Vin 1 0 ac 1

.ac dec 1k 100 10Meg

.control

run

plot vdb(3) xlog

plot (57.26*vp(3)) xlog

meas ac Cutoff_Freq when vdb(3)=-3 cross=last

.endc

.end

Output – The cut-off frequency(3dB) = 1.587775e+04 Hz

```
ngspice 35                                                    —    □    ×

ngspice 1 -> RLCAC.cir

No compatibility mode selected!

Circuit: *simple rlc circuit ac analysis

Doing analysis at TEMP = 27.000000 and TNOM = 27.000000

Warning: vin: has no value, DC 0 assumed

No. of Data Rows : 5001
cutoff_freq          =  1.587775e+04
ngspice 2 ->


RLCAC.cir                                    -- ready --        Quit
```


ac11: *simple rlc circuit ac analysis
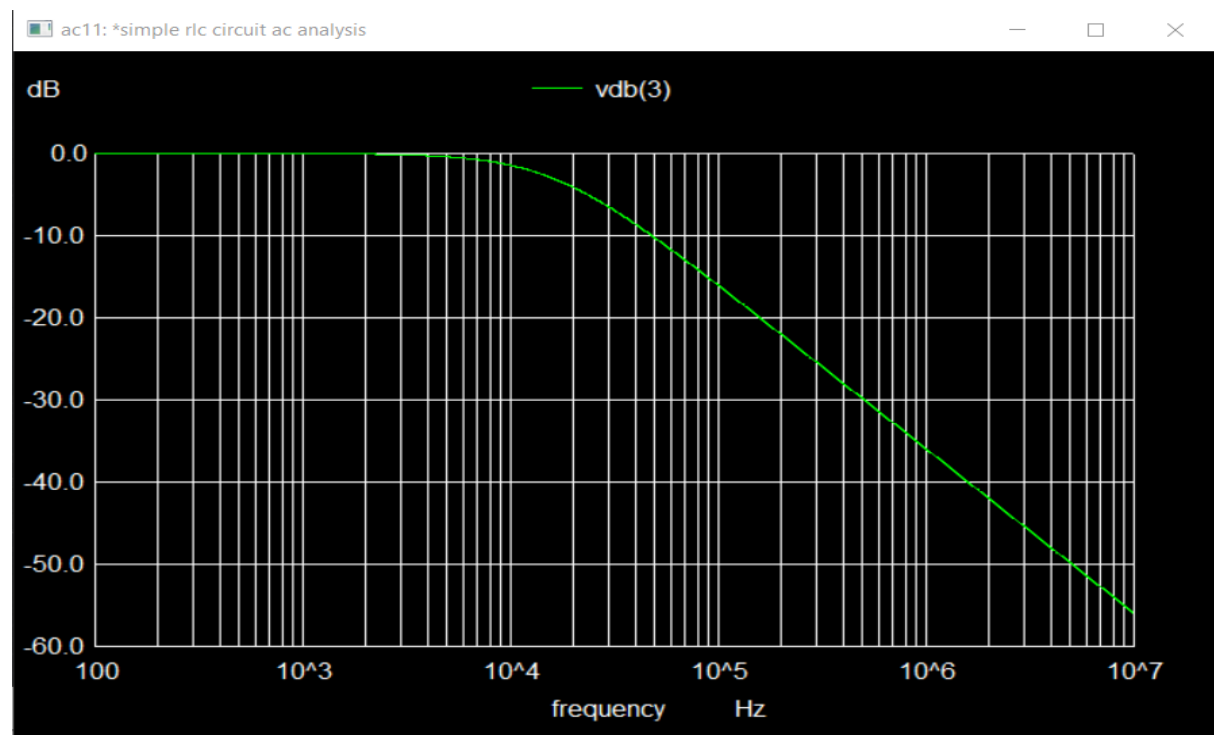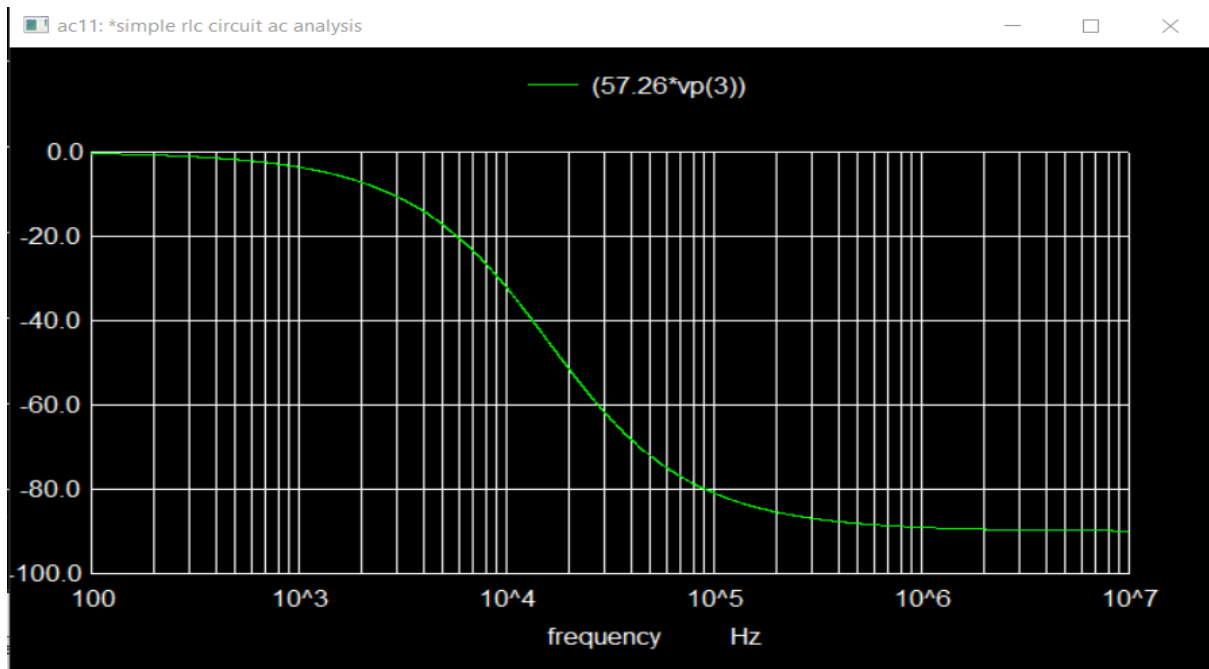
Question – Transient analysis of RLC series circuit

Code –

*Simple RLC circuit Transient Analysis

R 1 2 10Meg

L 2 3 0.1p

C 3 0 1p

Vin 1 0 dc 0 pulse(0 1 10u 1p 1p 50u 1)

.tran 10n 100u

.control

run

plot v(1) v(3)

plot v(1,2)

plot i(vin)

meas tran Rise_time trig v(3) val=0.1 rise=1 targ v(3) val=0.9 rise=1

print Rise_time

meas tran Fall_time trig v(3) val=0.9 fall=1 targ v(3) val=0.1 fall=1
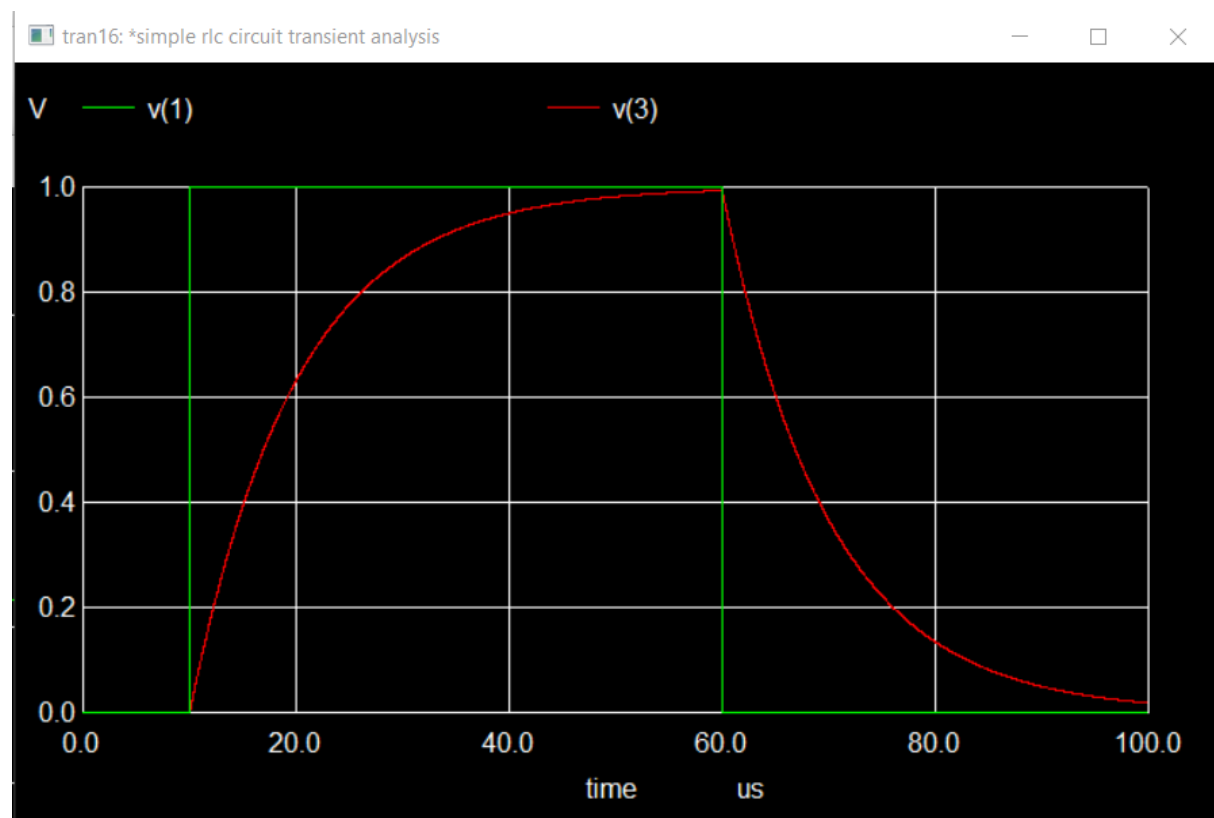
print Fall_time

.endc

.end

Output – Rise time = 2.197224e-05 s and Fall time = 2.197224e-05 s


```
----                                      --------
1                                            0
2                                            0
3                                            0
1#branch                                     0
vin#branch                                   0

No. of Data Rows : 10028
rise_time          =   2.197224e-05 targ=  3.302585e-05 trig=  1.105361e-05
rise_time = 2.197224e-05
fall_time          =   2.197224e-05 targ=  8.295370e-05 trig=  6.098146e-05
fall_time = 2.197224e-05
ngspice 18 ->
```
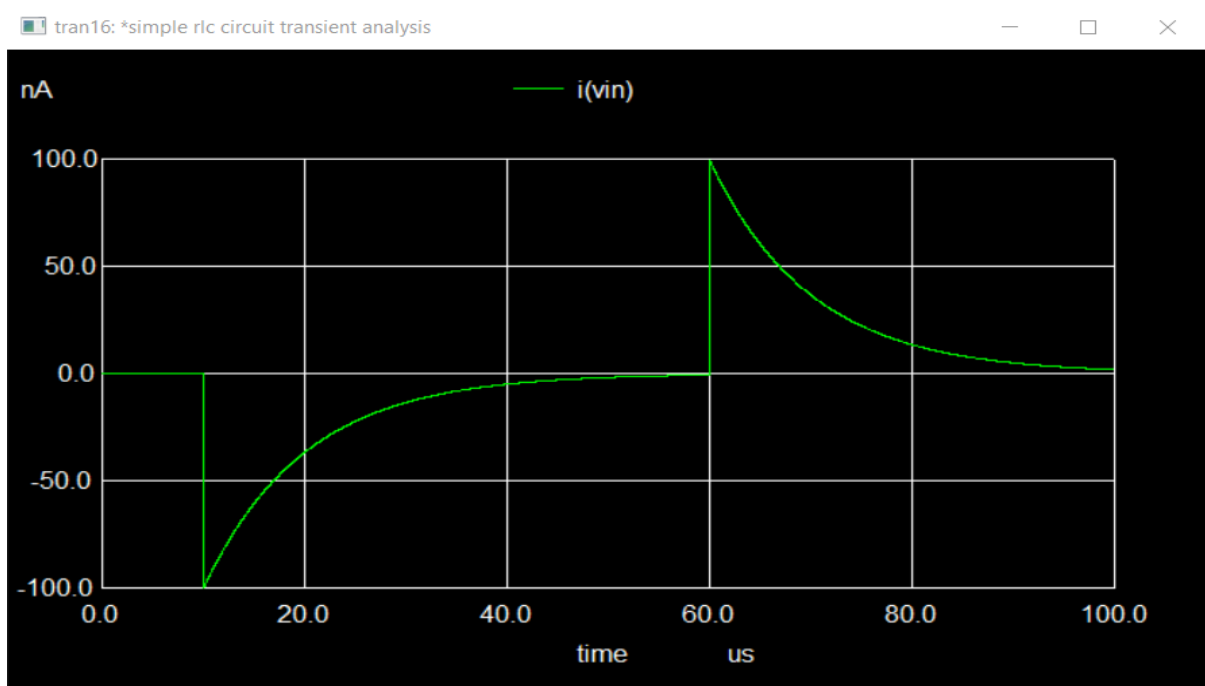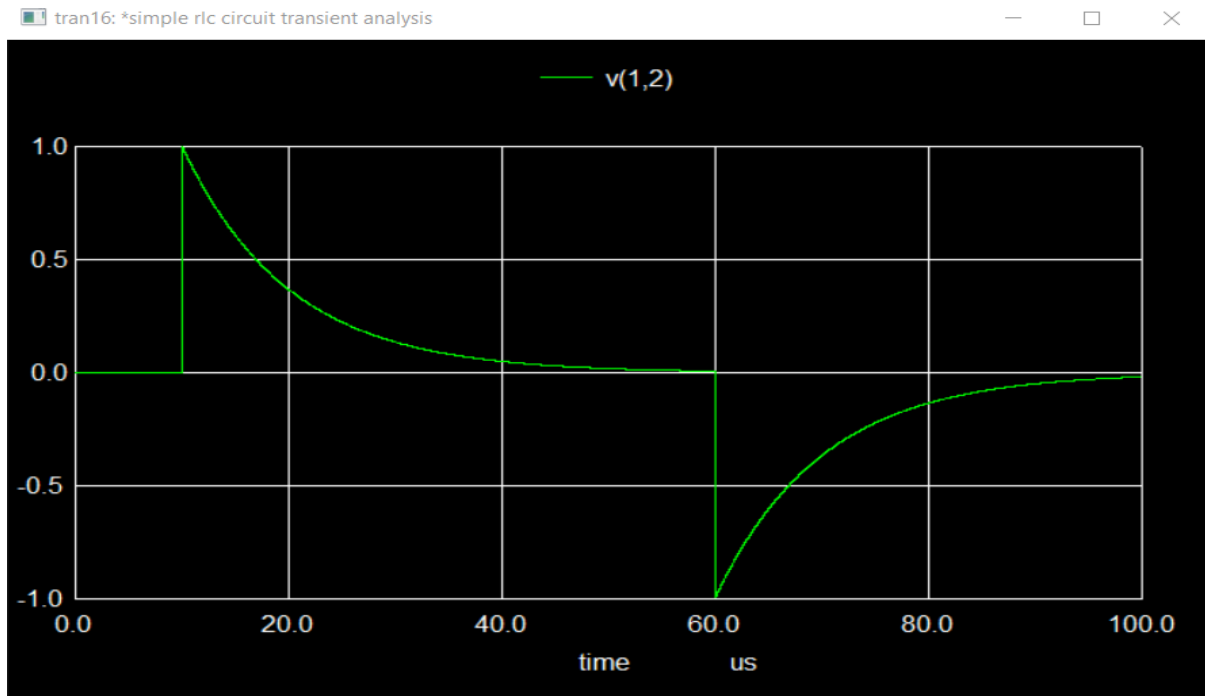
RLCtrans.cir   -- ready --   Quit

Conclusion –

- In series RLC circuit DC analysis, the response across the output(capacitor) can be observed as linear response and a very less current is flowing through the circuit.
- In series RLC circuit AC analysis, the output is observed as magnitude and phase response in which the cut-off frequency found as 15877.75 Hz and a rise and fall time can be observed in transient analysis.