Audit Course Session 4

AUDIT COURSE
ELECTRONIC CIRCUITS 2: SIMULATION BASED STUDY

Kindly update your name and roll no, once this document is shared with you
Time slot to complete your work is **40 MINUTES**
Date: 1/2/2021
Kindly upload your schematic & waveform images here, every 10 minutes, indicating your progress and intention to completion of WORK within time slot allotted

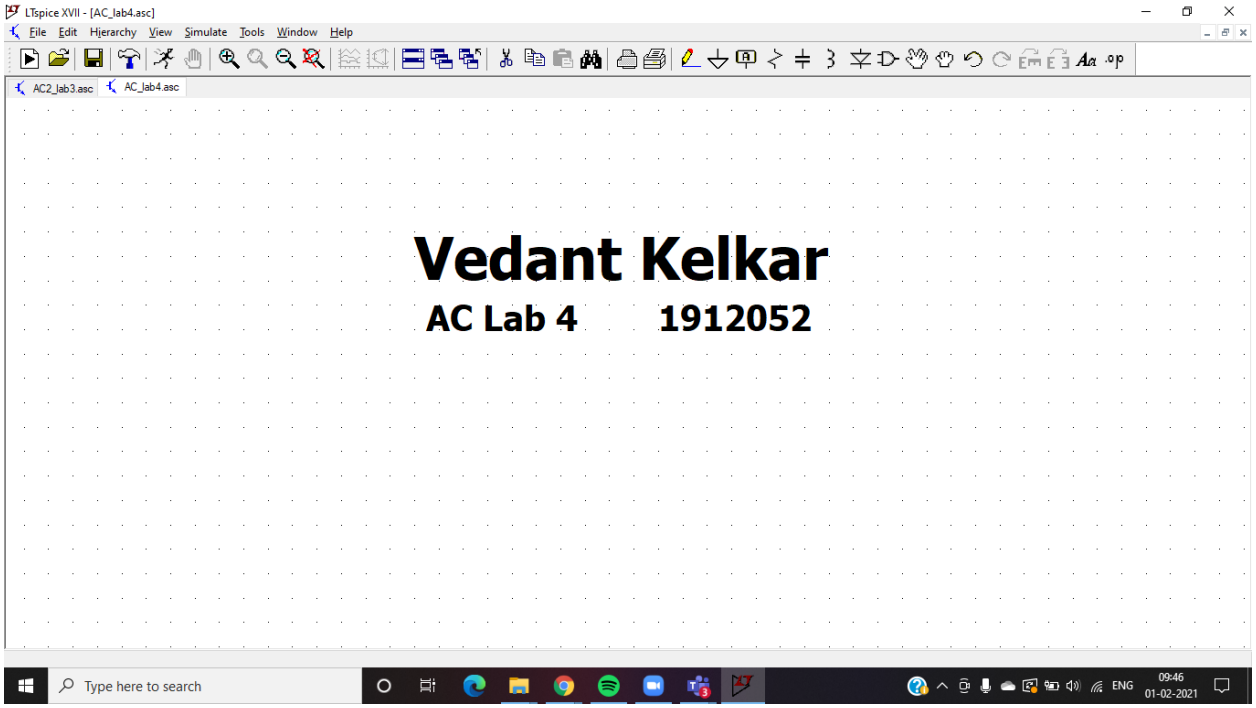
Time slot allotted to you all for the completion of Session 4 is 40 MINUTES

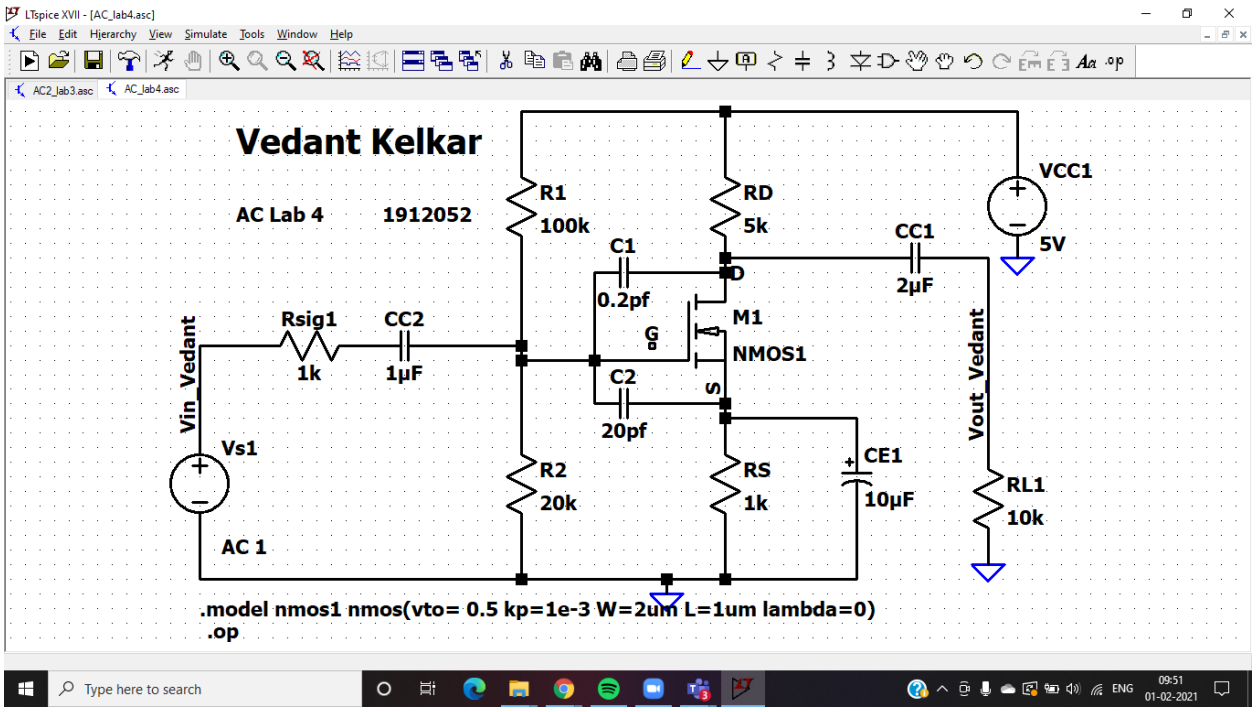
Kindly upload your work (only circuit schematic & waveform in LTSpice) in the shared google doc between this time slot only.

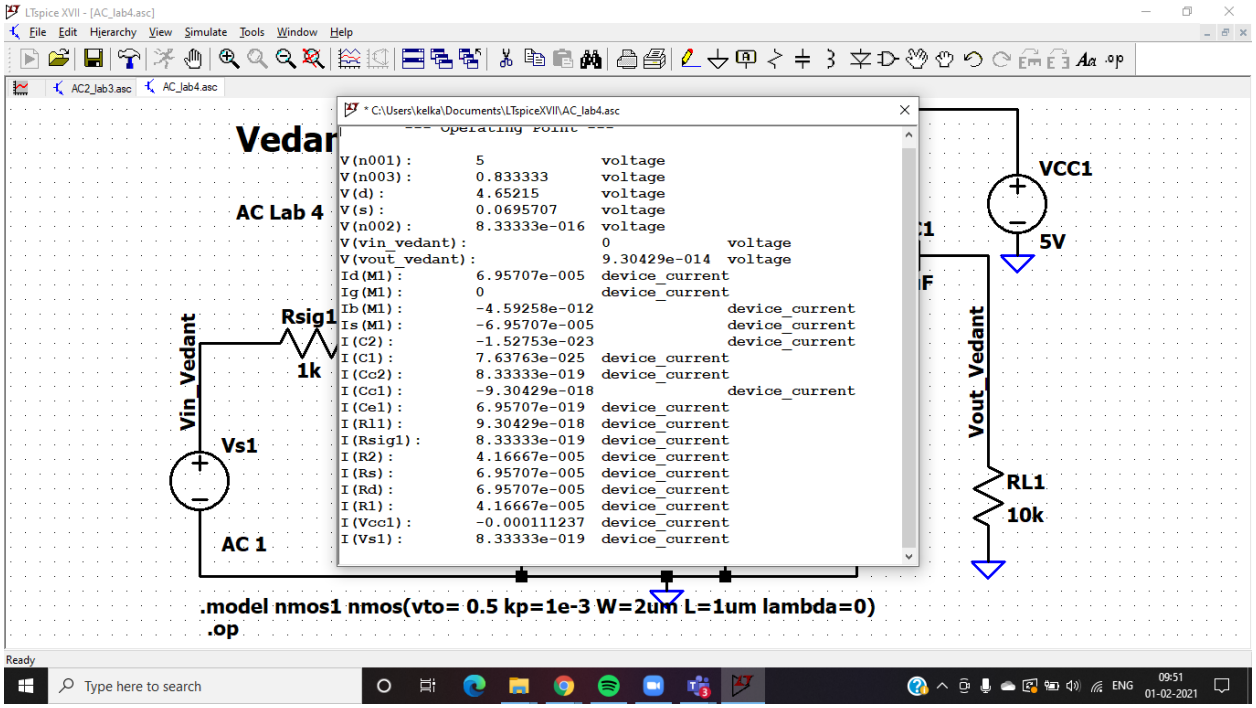
Follow these instruction strictly:
1, Start sharp ON TIME, by posting your name and roll no and **screenshot of your LT spice work screen (time and date MUST BE VISIBLE)**
2. Upload your work every 10 minutes, i.e LT spice work screen
3. This means you will upload LT spice work screen 4 times during this time slot.
4. Point 3 indicates your readiness and presences for completion of Session 4

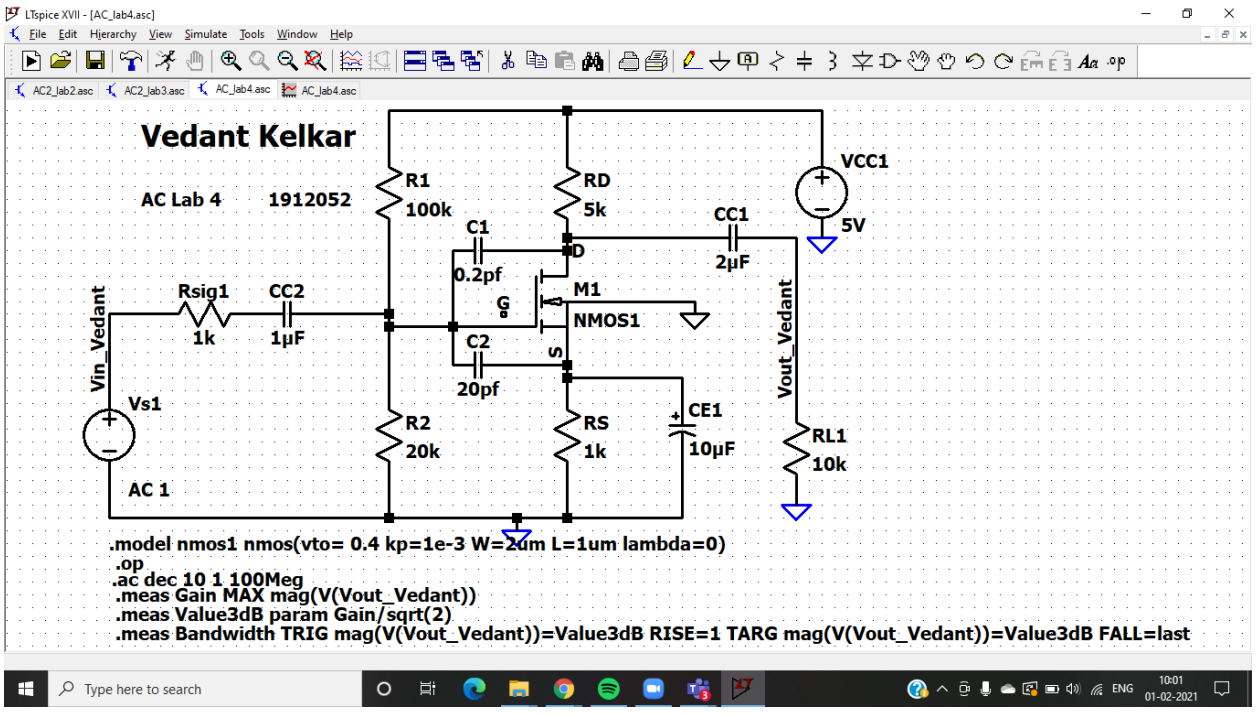
You are entitled for 10 points per session only if you follow above instruction to the details

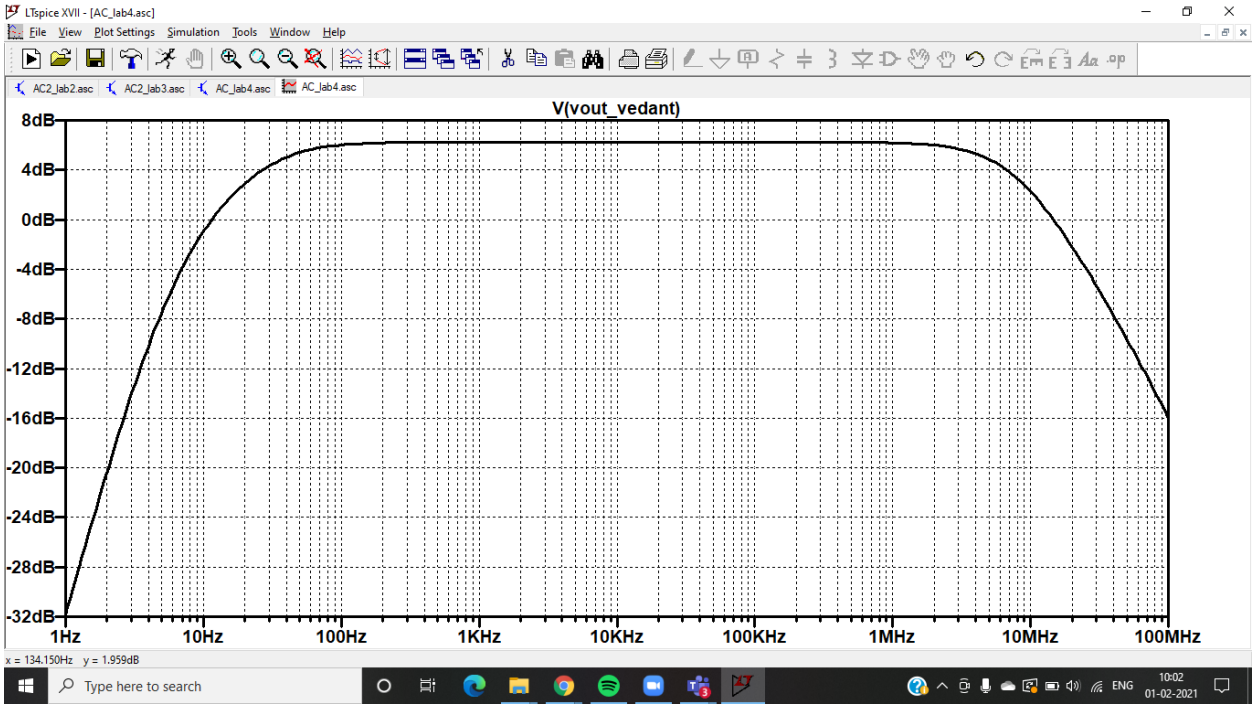
STUDENTS WORK AREA STARTS HERE

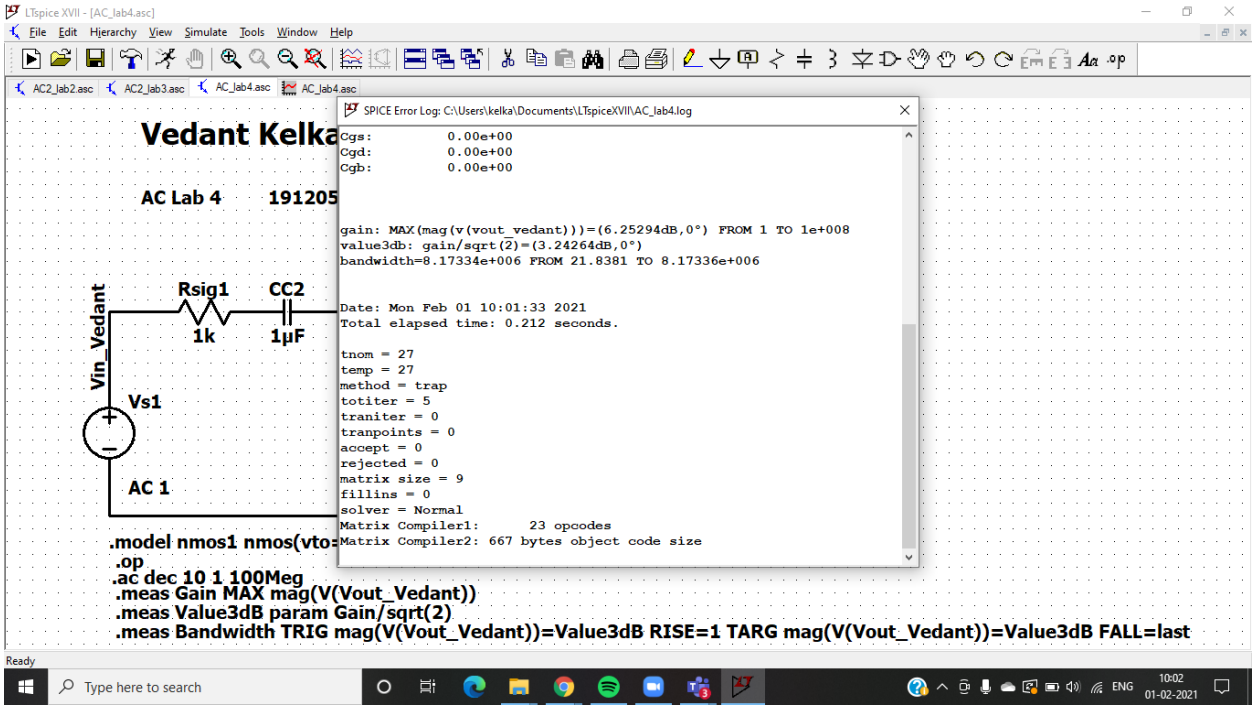

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab3.asc AC_lab4.asc
Vedant Kelkar
AC Lab 4 1912052
Type here to search
ENG
09:46
01-02-2021

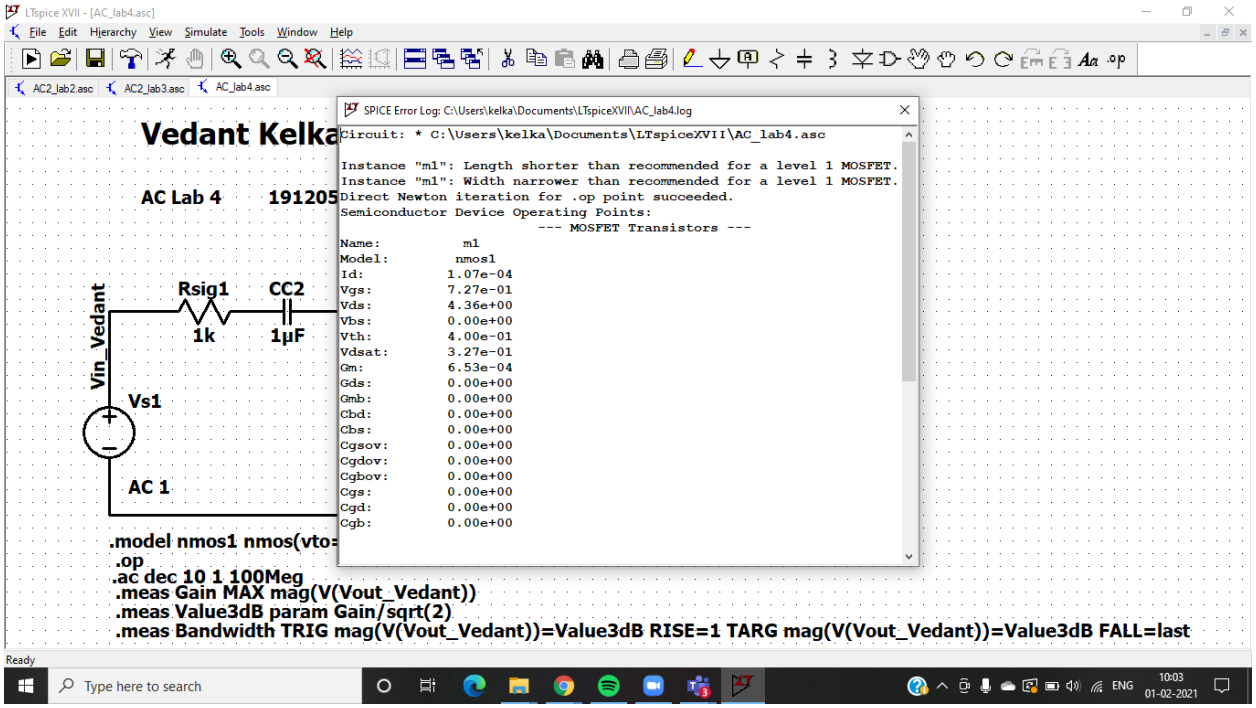

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab3.asc AC_lab4.asc
Vedant Kelkar
AC Lab 4 1912052
R1
100k
RD
5k
VCC1
5V
C1
0.2pf
CC1
2µF
D
M1
NMOS1
G
S
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
C2
20pf
R2
20k
RS
1k
CE1
10µF
Vout_Vedant
RL1
10k
.model nmos1 nmos(vto= 0.5 kp=1e-3 W=2um L=1um lambda=0)
.op
Type here to search
ENG
09:51
01-02-2021


LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab3.asc AC_lab4.asc
Vedar
AC Lab 4
C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.asc
V(n001): 5 voltage
V(n003): 0.833333 voltage
V(d): 4.65215 voltage
V(s): 0.0695707 voltage
V(n002): 8.33333e-016 voltage
V(vin_vedant): 0 voltage
V(vout_vedant): 9.30429e-014 voltage
Id(M1): 6.95707e-005 device_current
Ig(M1): 0 device_current
Ib(M1): -4.59258e-012 device_current
Is(M1): -6.95707e-005 device_current
I(C2): -1.52753e-023 device_current
I(C1): 7.63763e-025 device_current
I(Cc2): 8.33333e-019 device_current
I(Cc1): -9.30429e-018 device_current
I(Ce1): 6.95707e-019 device_current
I(Rl1): 9.30429e-018 device_current
I(Rsig1): 8.33333e-019 device_current
I(R2): 4.16667e-005 device_current
I(Rs): 6.95707e-005 device_current
I(Rd): 6.95707e-005 device_current
I(R1): 4.16667e-005 device_current
I(Vcc1): -0.000111237 device_current
I(Vs1): 8.33333e-019 device_current
VCC1
5V
Rsig1
1k
Vin_Vedant
Vs1
AC 1
Vout_Vedant
RL1
10k
.model nmos1 nmos(vto= 0.5 kp=1e-3 W=2um L=1um lambda=0)
.op
Ready
Type here to search
ENG
09:51
01-02-2021


LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
Vedant Kelkar
AC Lab 4 1912052
R1
100k
RD
5k
VCC1
5V
C1
0.2pf
CC1
2µF
D
M1
NMOS1
G
S
Rsig1
1k
CC2
1µF
Vin_Vedant
C2
20pf
Vs1
AC 1
R2
20k
RS
1k
CE1
10µF
Vout_Vedant
RL1
10k
.model nmos1 nmos(vto= 0.4 kp=1e-3 W=2um L=1um lambda=0)
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Type here to search
ENG
10:01
01-02-2021

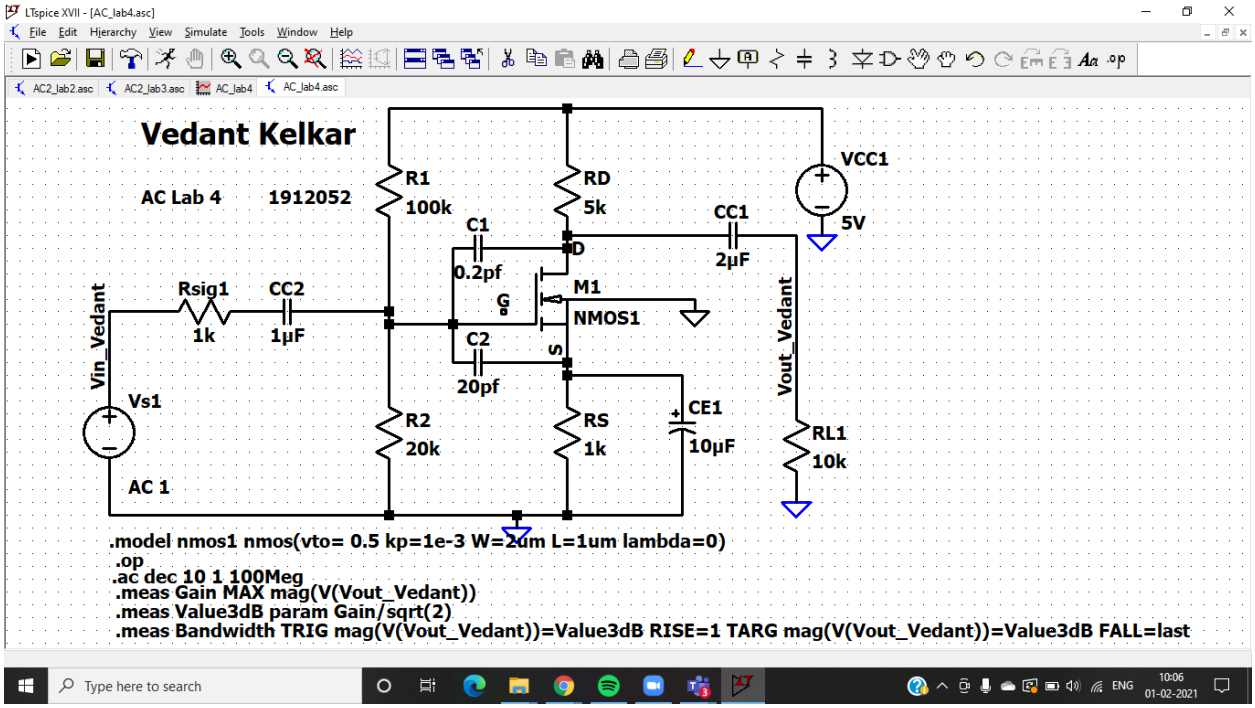

LTspice XVII - [AC_lab4.asc]
File View Plot Settings Simulation Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
V(vout_vedant)
8dB
4dB
0dB
-4dB
-8dB
-12dB
-16dB
-20dB
-24dB
-28dB
-32dB
1Hz
10Hz
100Hz
1KHz
10KHz
100KHz
1MHz
10MHz
100MHz
x = 134.150Hz y = 1.959dB
Type here to search
ENG
10:02
01-02-2021

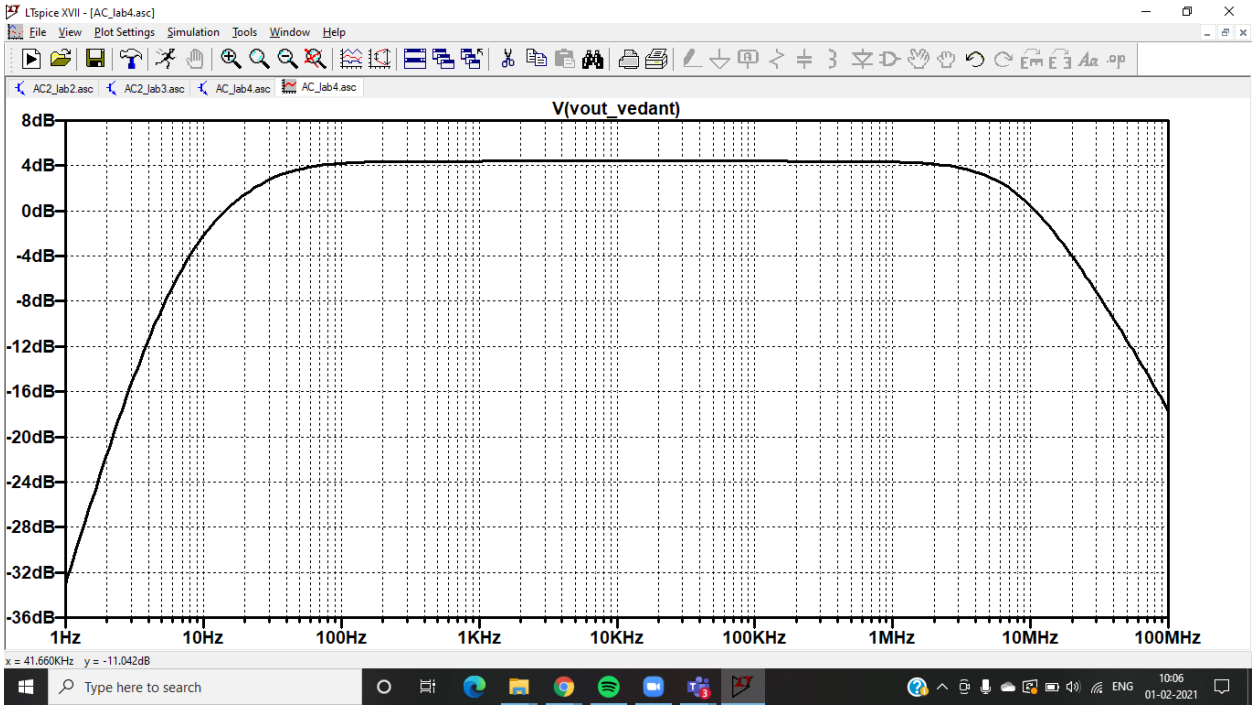

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
Vedant Kelka
AC Lab 4 191205
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
.model nmos1 nmos(vto=
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
SPICE Error Log: C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.log
Cgs: 0.00e+00
Cgd: 0.00e+00
Cgb: 0.00e+00
gain: MAX(mag(v(vout_vedant)))=(6.25294dB,0°) FROM 1 TO 1e+008
value3db: gain/sqrt(2)=(3.24264dB,0°)
bandwidth=8.17334e+006 FROM 21.8381 TO 8.17336e+006
Date: Mon Feb 01 10:01:33 2021
Total elapsed time: 0.212 seconds.
tnom = 27
temp = 27
method = trap
totiter = 5
traniter = 0
tranpoints = 0
accept = 0
rejected = 0
matrix size = 9
fillins = 0
solver = Normal
Matrix Compiler1: 23 opcodes
Matrix Compiler2: 667 bytes object code size
Ready
Type here to search
ENG
10:02
01-02-2021

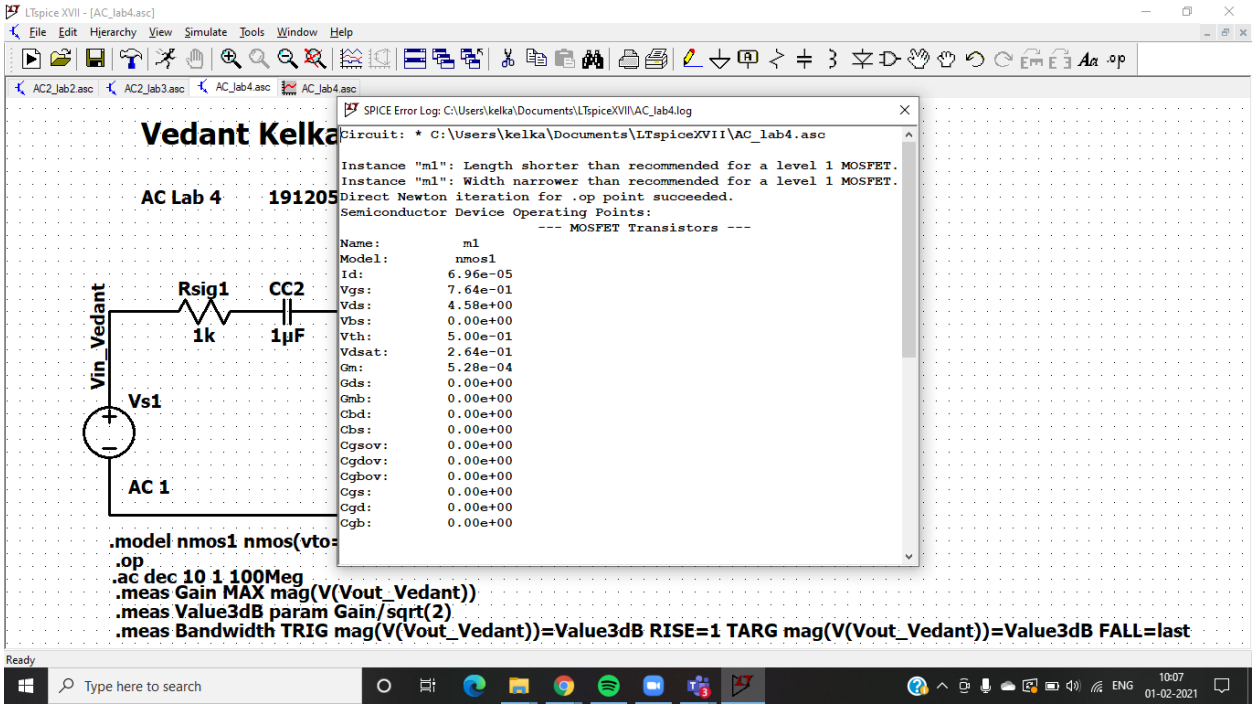


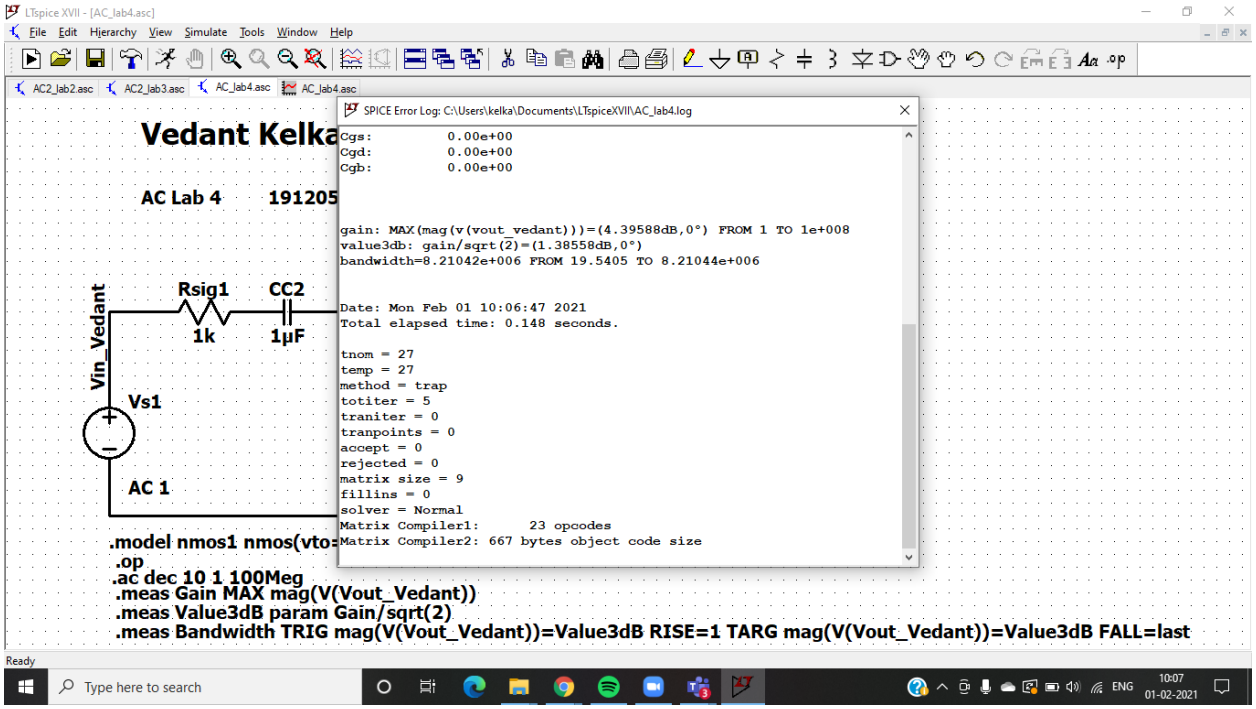
Parameters	Calculated	Simulated
Id	106.667 uA	107 A
Vgs	0.7266 V	0.727 V
gm	653.2 mA/V	653 mA/V
fL	26.32 Hz	21.8248 Hz
Avmid	6.2523 dB	6.25075 dB
fH	8.185 MHz	8.17336e+006 Hz
BW	8.1849 MHz	8.17334e+006 Hz

EX1 Vth=0.5

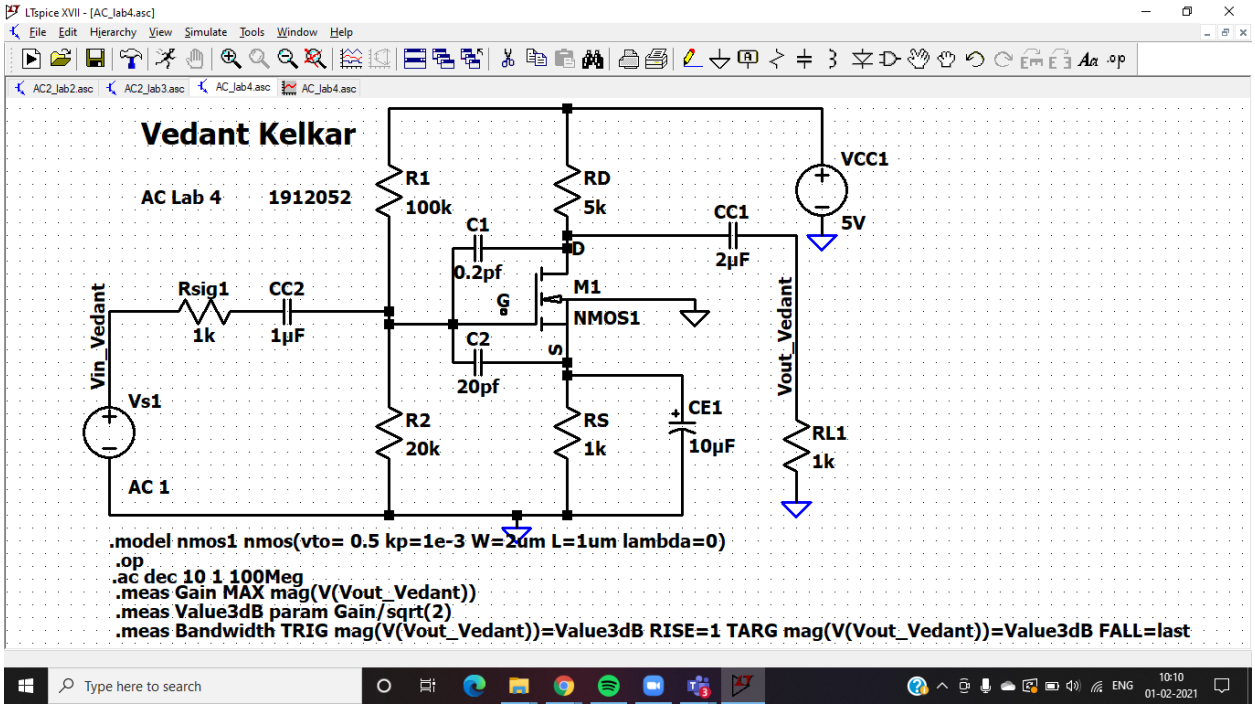

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4 AC_lab4.asc
Vedant Kelkar
AC Lab 4 1912052
R1
100k
RD
5k
VCC1
5V
C1
0.2pf
CC1
2µF
D
M1
NMOS1
G
S
Rsig1
1k
CC2
1µF
Vin_Vedant
Vout_Vedant
C2
20pf
Vs1
AC 1
R2
20k
RS
1k
CE1
10µF
RL1
10k
.model nmos1 nmos(vto= 0.5 kp=1e-3 W=2um L=1um lambda=0)
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Type here to search
ENG
10:06
01-02-2021

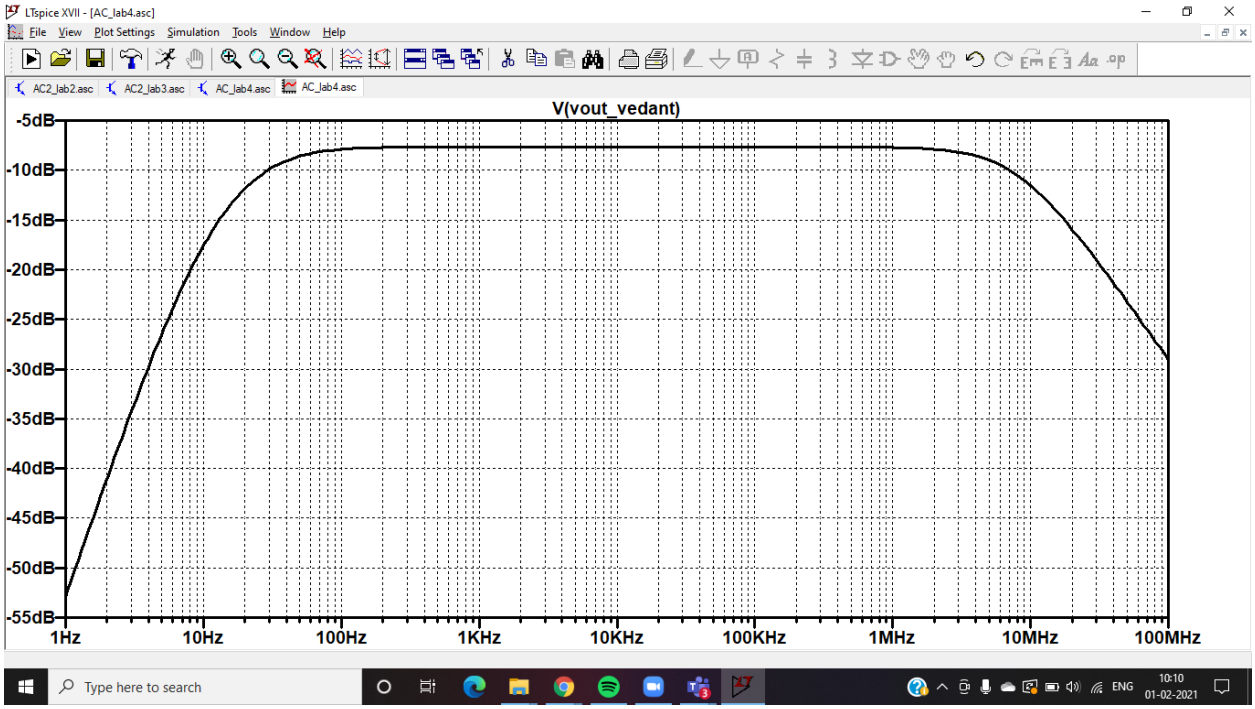

LTspice XVII - [AC_lab4.asc]
File View Plot Settings Simulation Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
V(vout_vedant)
8dB
4dB
0dB
-4dB
-8dB
-12dB
-16dB
-20dB
-24dB
-28dB
-32dB
-36dB
1Hz
10Hz
100Hz
1KHz
10KHz
100KHz
1MHz
10MHz
100MHz
x = 41.660KHz y = -11.042dB
Type here to search
ENG
10:06
01-02-2021

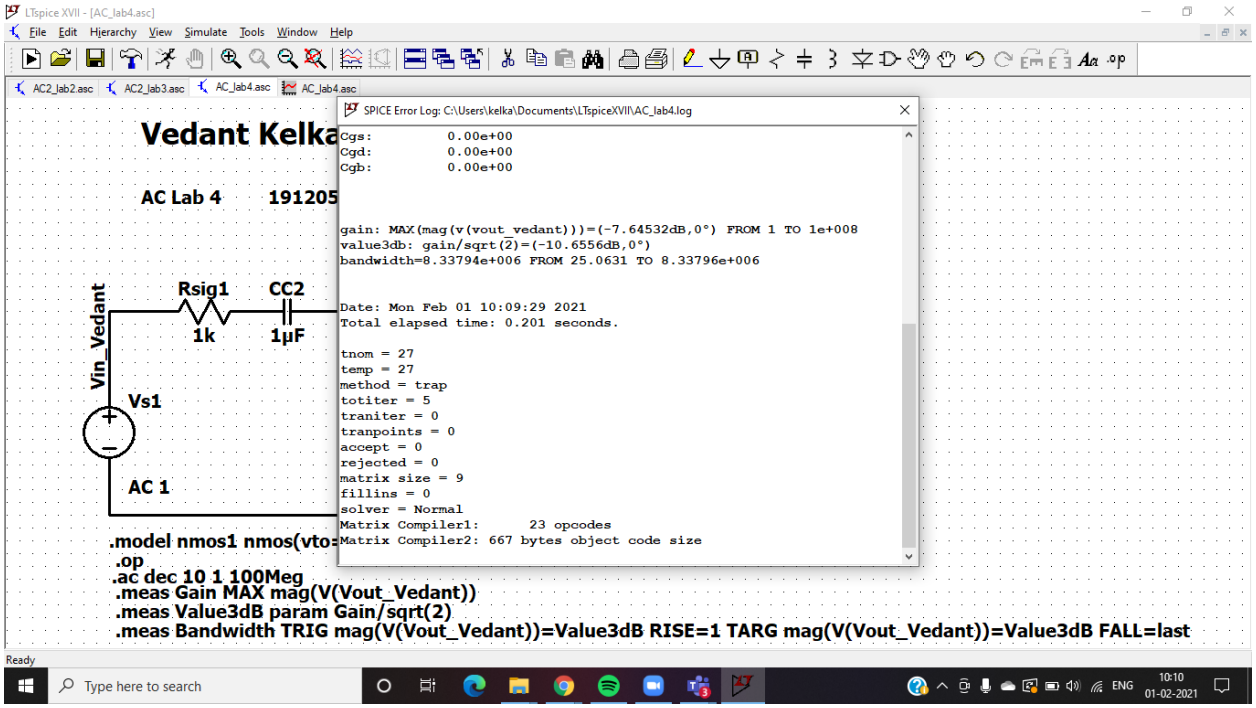

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
SPICE Error Log: C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.log
Circuit: * C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.asc
Instance "m1": Length shorter than recommended for a level 1 MOSFET.
Instance "m1": Width narrower than recommended for a level 1 MOSFET.
Direct Newton iteration for .op point succeeded.
Semiconductor Device Operating Points:
--- MOSFET Transistors ---
Name: m1
Model: nmos1
Id: 6.96e-05
Vgs: 7.64e-01
Vds: 4.58e+00
Vbs: 0.00e+00
Vth: 5.00e-01
Vdsat: 2.64e-01
Gm: 5.28e-04
Gds: 0.00e+00
Gmb: 0.00e+00
Cbd: 0.00e+00
Cbs: 0.00e+00
Cgsov: 0.00e+00
Cgdov: 0.00e+00
Cgbov: 0.00e+00
Cgs: 0.00e+00
Cgd: 0.00e+00
Cgb: 0.00e+00
Vedant Kelka
AC Lab 4 191205
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
.model nmos1 nmos(vto=
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Ready
Type here to search
ENG
10:07
01-02-2021

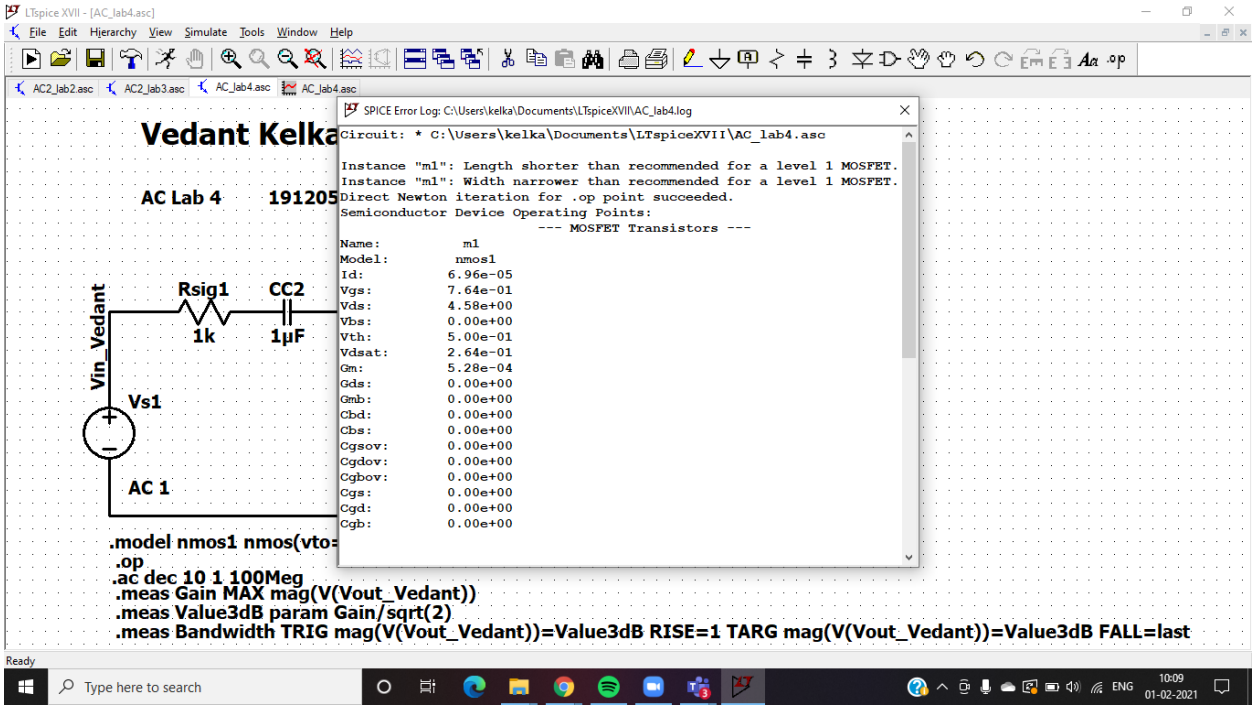

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
SPICE Error Log: C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.log
Cgs: 0.00e+00
Cgd: 0.00e+00
Cgb: 0.00e+00
gain: MAX(mag(v(vout_vedant)))=(4.39588dB,0°) FROM 1 TO 1e+008
value3db: gain/sqrt(2)=(1.38558dB,0°)
bandwidth=8.21042e+006 FROM 19.5405 TO 8.21044e+006
Date: Mon Feb 01 10:06:47 2021
Total elapsed time: 0.148 seconds.
tnom = 27
temp = 27
method = trap
totiter = 5
traniter = 0
tranpoints = 0
accept = 0
rejected = 0
matrix size = 9
fillins = 0
solver = Normal
Matrix Compiler1: 23 opcodes
Matrix Compiler2: 667 bytes object code size
Vedant Kelka
AC Lab 4 191205
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
.model nmos1 nmos(vto=
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Ready
Type here to search
ENG
10:07
01-02-2021

EX2 RL=1k

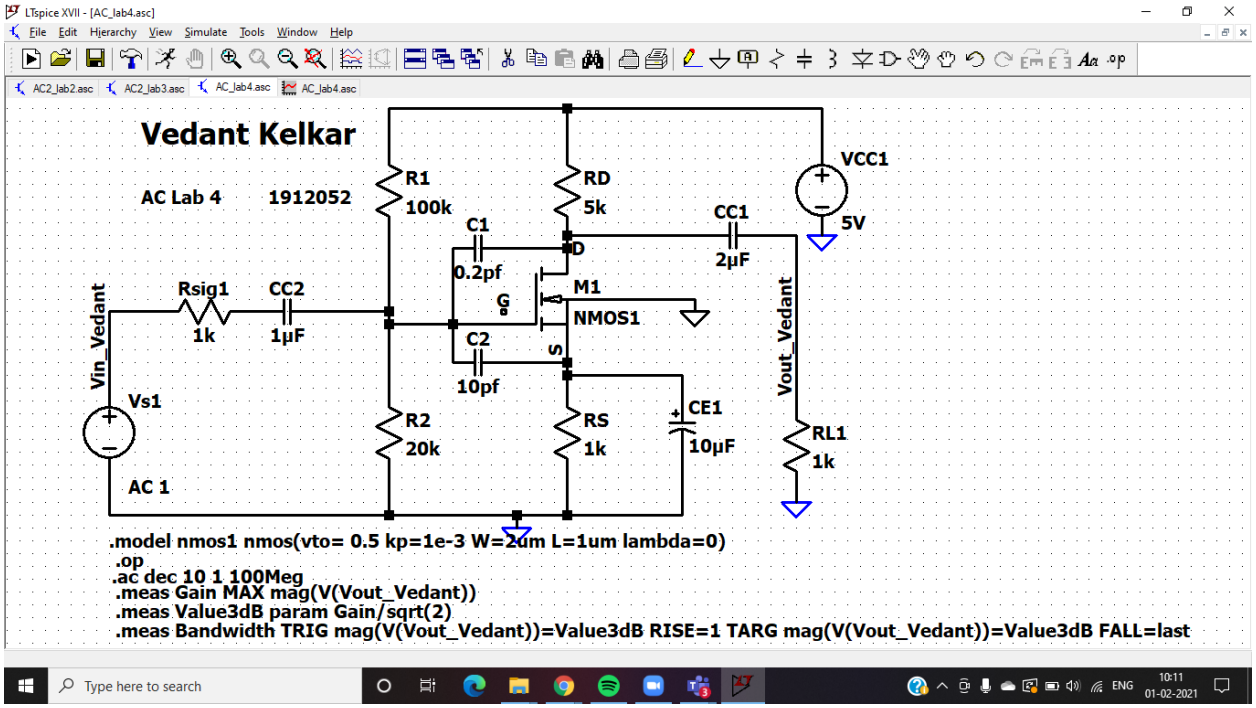

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
Vedant Kelkar
AC Lab 4 1912052
R1
100k
RD
5k
VCC1
5V
C1
0.2pf
CC1
2µF
D
M1
NMOS1
G
S
Rsig1
1k
CC2
1µF
Vin_Vedant
Vout_Vedant
C2
20pf
Vs1
AC 1
R2
20k
RS
1k
CE1
10µF
RL1
1k
.model nmos1 nmos(vto= 0.5 kp=1e-3 W=2um L=1um lambda=0)
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Type here to search
ENG
10:10
01-02-2021

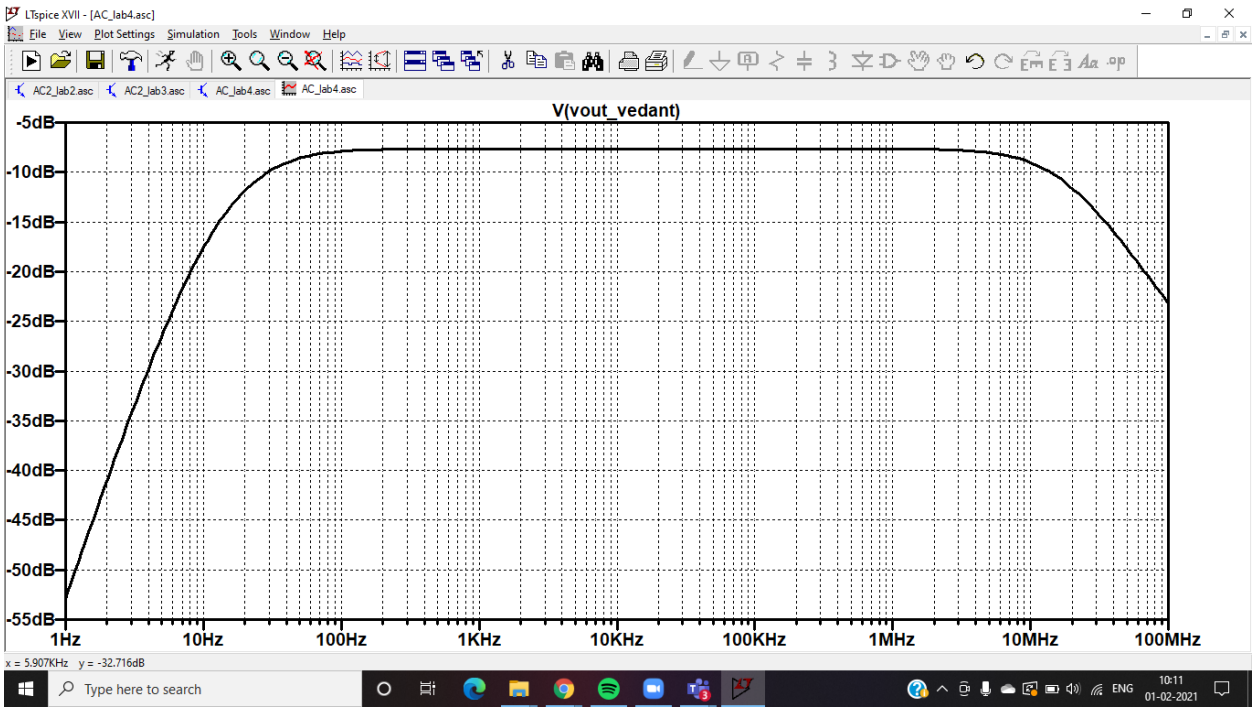

LTspice XVII - [AC_lab4.asc]
File View Plot Settings Simulation Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
V(vout_vedant)
-5dB
-10dB
-15dB
-20dB
-25dB
-30dB
-35dB
-40dB
-45dB
-50dB
-55dB
1Hz
10Hz
100Hz
1KHz
10KHz
100KHz
1MHz
10MHz
100MHz
Type here to search
ENG
10:10
01-02-2021

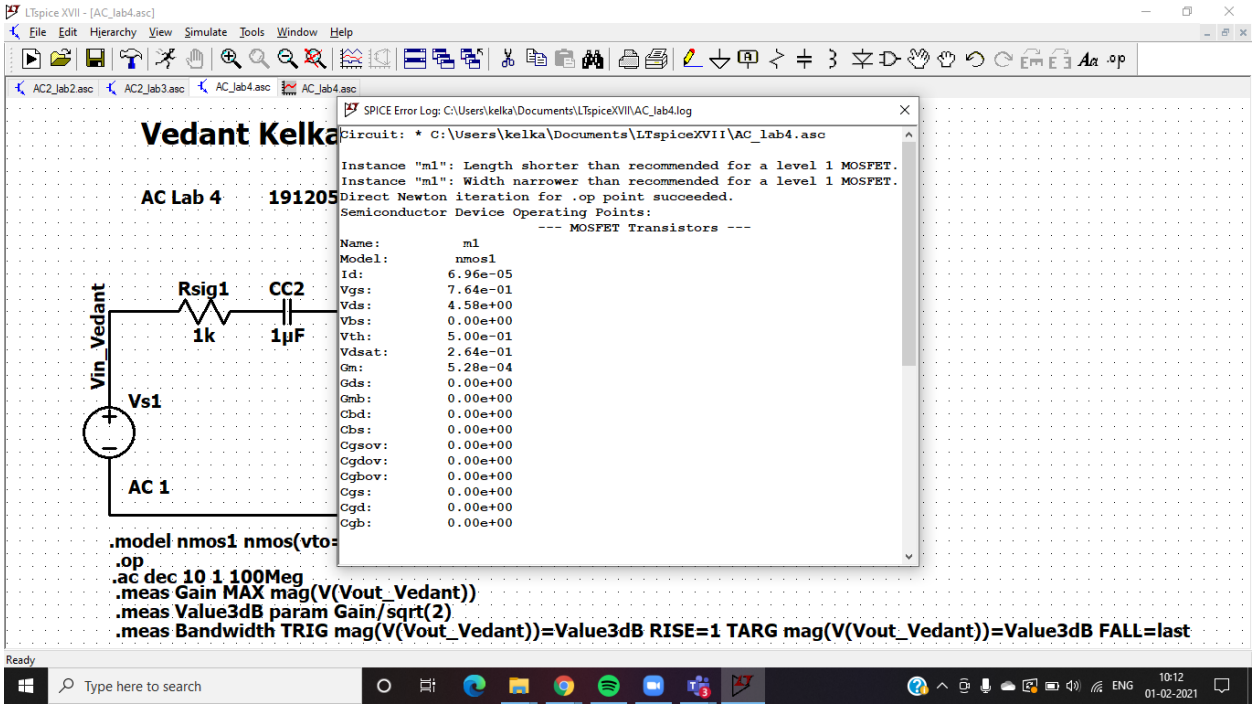

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
SPICE Error Log: C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.log
Vedant Kelka
AC Lab 4 191205
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
Cgs: 0.00e+00
Cgd: 0.00e+00
Cgb: 0.00e+00
gain: MAX(mag(v(vout_vedant)))=(-7.64532dB,0°) FROM 1 TO 1e+008
value3db: gain/sqrt(2)=(-10.6556dB,0°)
bandwidth=8.33794e+006 FROM 25.0631 TO 8.33796e+006
Date: Mon Feb 01 10:09:29 2021
Total elapsed time: 0.201 seconds.
tnom = 27
temp = 27
method = trap
totiter = 5
traniter = 0
tranpoints = 0
accept = 0
rejected = 0
matrix size = 9
fillins = 0
solver = Normal
Matrix Compiler1: 23 opcodes
Matrix Compiler2: 667 bytes object code size
.model nmos1 nmos(vto=
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Ready
Type here to search
ENG
10:10
01-02-2021

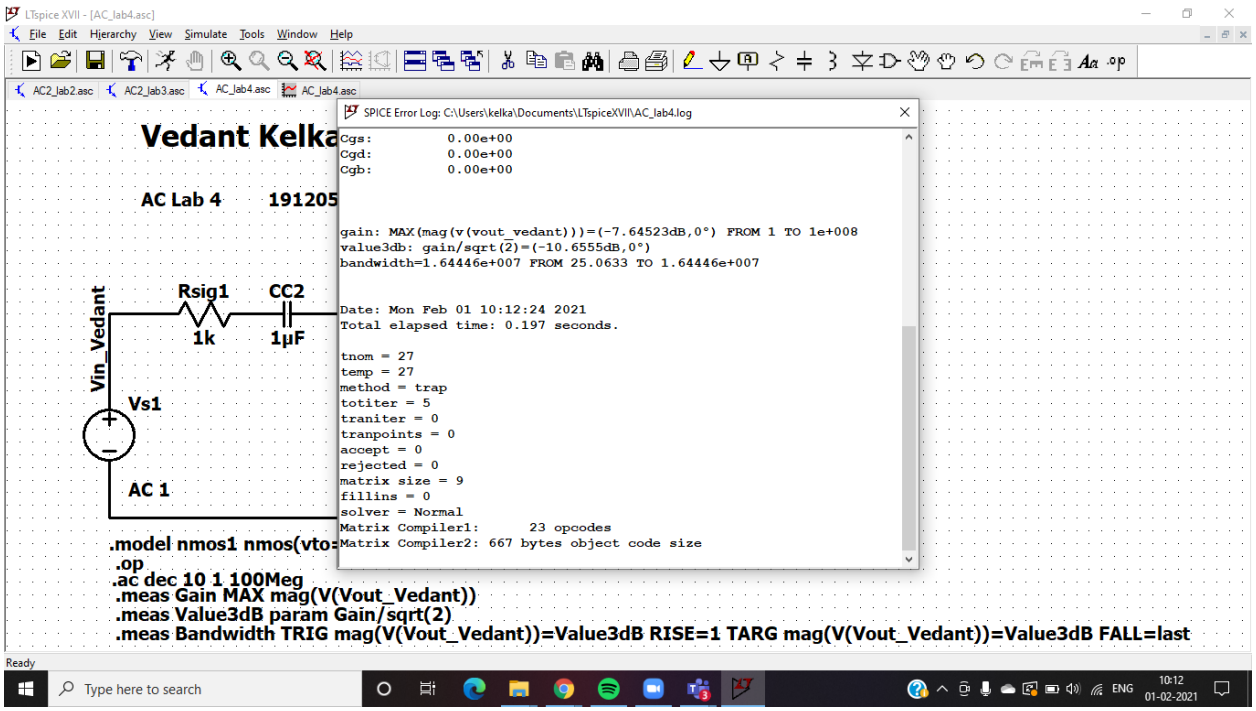

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
SPICE Error Log: C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.log
Vedant Kelka
AC Lab 4 191205
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
Circuit: * C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.asc
Instance "m1": Length shorter than recommended for a level 1 MOSFET.
Instance "m1": Width narrower than recommended for a level 1 MOSFET.
Direct Newton iteration for .op point succeeded.
Semiconductor Device Operating Points:
--- MOSFET Transistors ---
Name: m1
Model: nmos1
Id: 6.96e-05
Vgs: 7.64e-01
Vds: 4.58e+00
Vbs: 0.00e+00
Vth: 5.00e-01
Vdsat: 2.64e-01
Gm: 5.28e-04
Gds: 0.00e+00
Gmb: 0.00e+00
Cbd: 0.00e+00
Cbs: 0.00e+00
Cgsov: 0.00e+00
Cgdov: 0.00e+00
Cgbov: 0.00e+00
Cgs: 0.00e+00
Cgd: 0.00e+00
Cgb: 0.00e+00
.model nmos1 nmos(vto=
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Ready
Type here to search
ENG
10:09
01-02-2021

EX3 Cgs=20pf

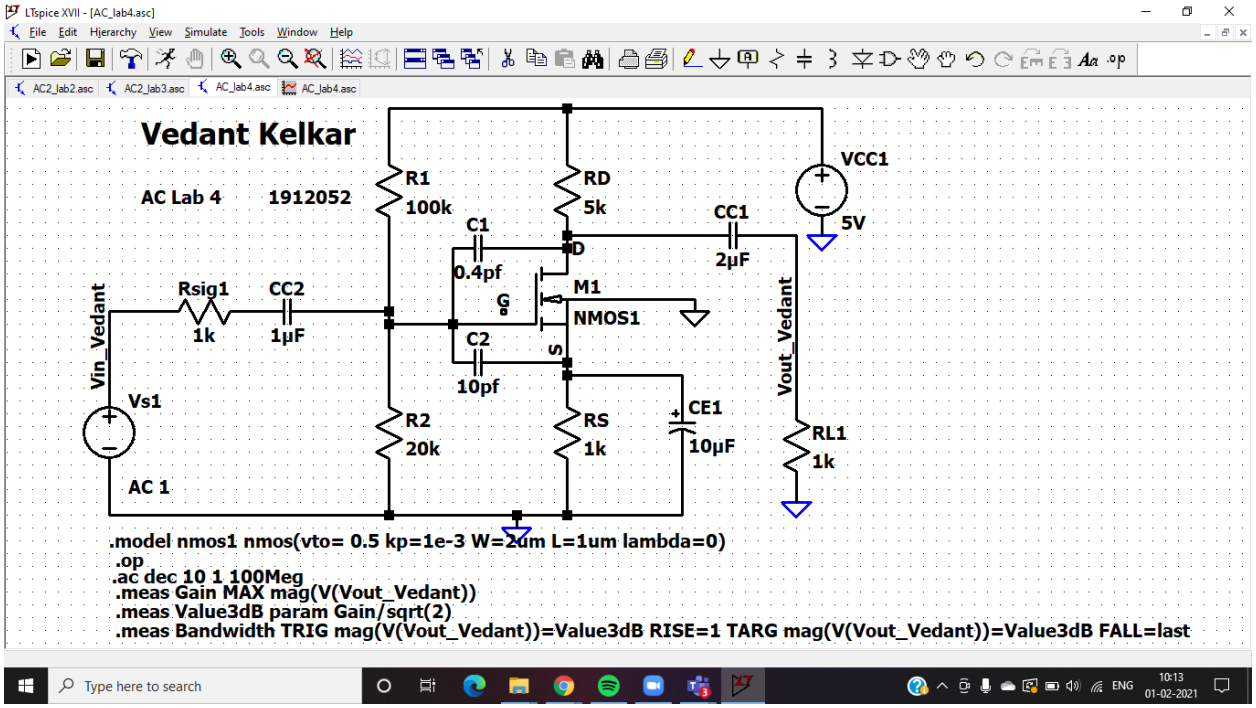

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
Vedant Kelkar
AC Lab 4 1912052
R1
100k
RD
5k
VCC1
5V
C1
0.2pf
CC1
2µF
D
M1
NMOS1
G
S
Rsig1
1k
CC2
1µF
Vin_Vedant
Vout_Vedant
C2
10pf
Vs1
AC 1
R2
20k
RS
1k
CE1
10µF
RL1
1k
.model nmos1 nmos(vto= 0.5 kp=1e-3 W=2um L=1um lambda=0)
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Type here to search
ENG
10:11
01-02-2021

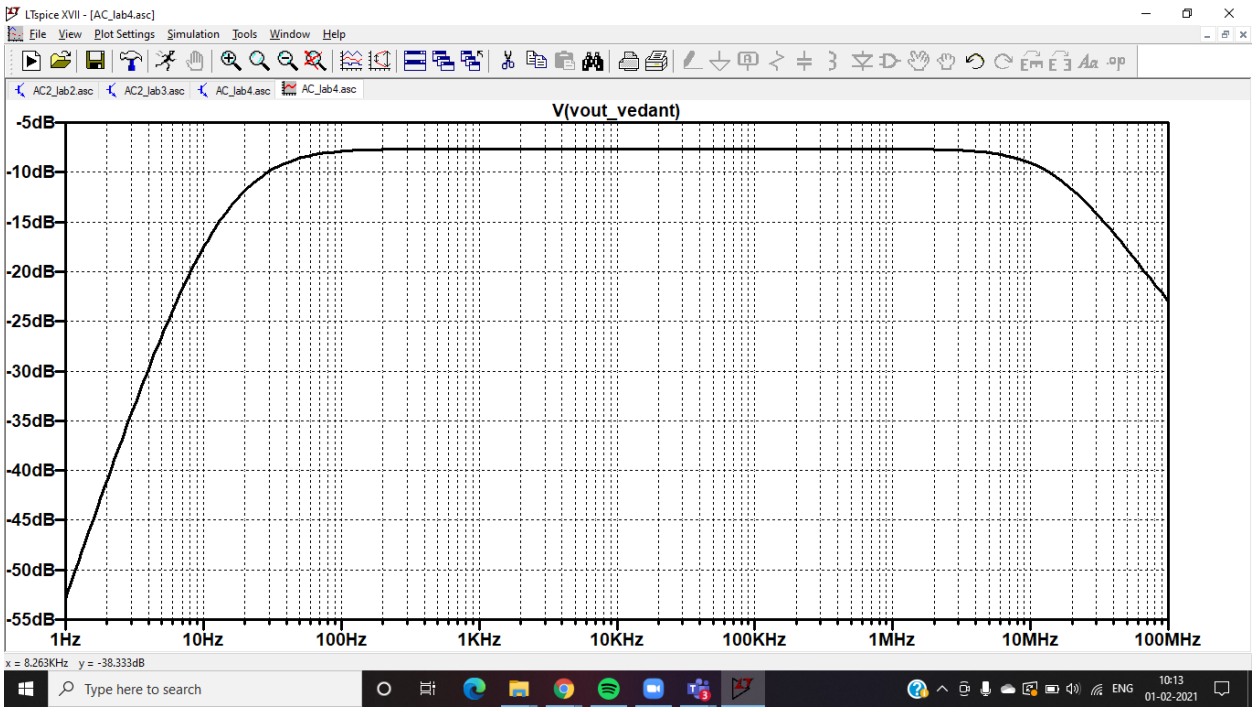

LTspice XVII - [AC_lab4.asc]
File View Plot Settings Simulation Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
V(vout_vedant)
-5dB
-10dB
-15dB
-20dB
-25dB
-30dB
-35dB
-40dB
-45dB
-50dB
-55dB
1Hz
10Hz
100Hz
1KHz
10KHz
100KHz
1MHz
10MHz
100MHz
x = 5.907KHz y = -32.716dB
Type here to search
ENG
10:11
01-02-2021

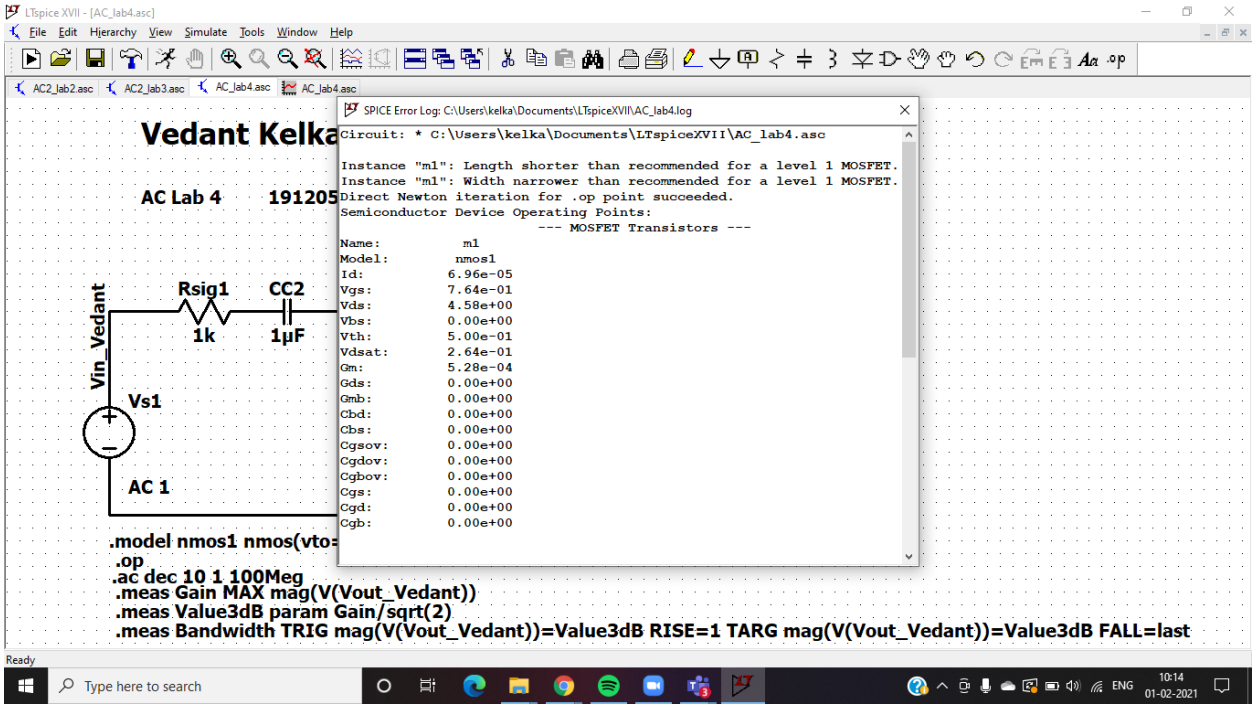

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
SPICE Error Log: C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.log
Circuit: * C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.asc
Instance "m1": Length shorter than recommended for a level 1 MOSFET.
Instance "m1": Width narrower than recommended for a level 1 MOSFET.
Direct Newton iteration for .op point succeeded.
Semiconductor Device Operating Points:
--- MOSFET Transistors ---
Name: m1
Model: nmos1
Id: 6.96e-05
Vgs: 7.64e-01
Vds: 4.58e+00
Vbs: 0.00e+00
Vth: 5.00e-01
Vdsat: 2.64e-01
Gm: 5.28e-04
Gds: 0.00e+00
Gmb: 0.00e+00
Cbd: 0.00e+00
Cbs: 0.00e+00
Cgsov: 0.00e+00
Cgdov: 0.00e+00
Cgbov: 0.00e+00
Cgs: 0.00e+00
Cgd: 0.00e+00
Cgb: 0.00e+00
Vedant Kelka
AC Lab 4 191205
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
.model nmos1 nmos(vto=
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Ready
Type here to search
ENG
10:12
01-02-2021

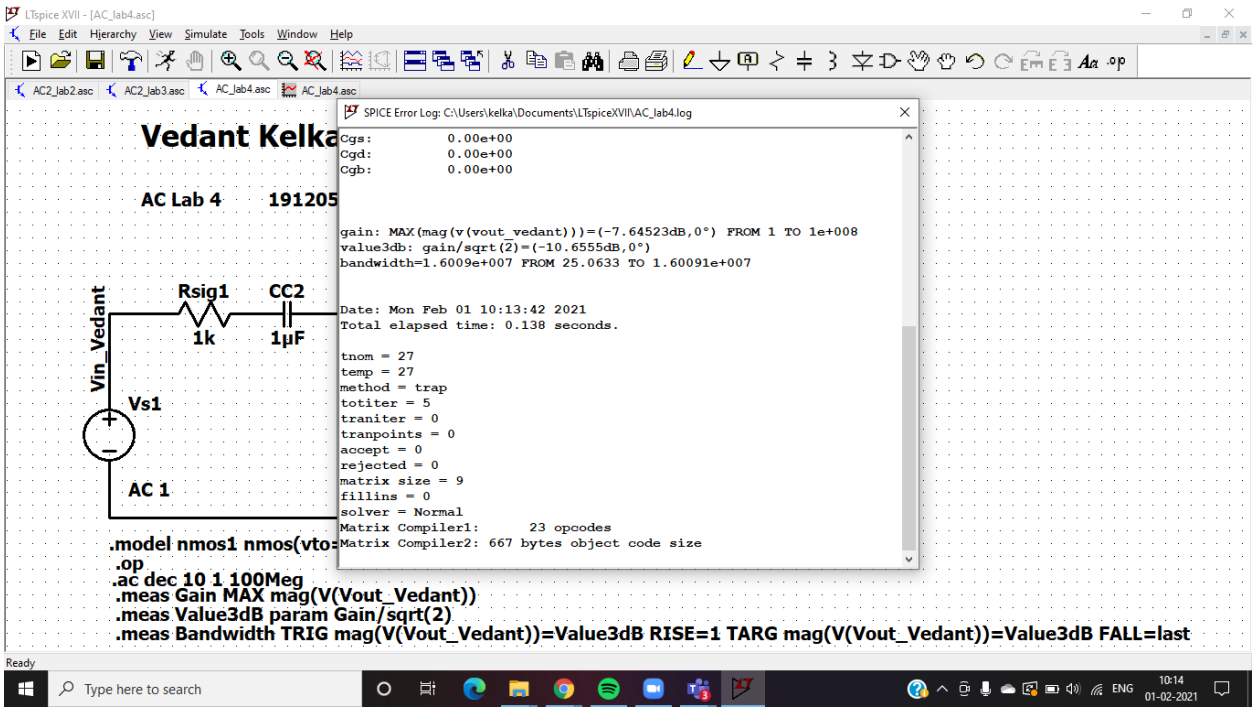

LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
SPICE Error Log: C:\Users\kelka\Documents\LTspiceXVII\AC_lab4.log
Cgs: 0.00e+00
Cgd: 0.00e+00
Cgb: 0.00e+00
gain: MAX(mag(v(vout_vedant)))=(-7.64523dB,0°) FROM 1 TO 1e+008
value3db: gain/sqrt(2)=(-10.6555dB,0°)
bandwidth=1.64446e+007 FROM 25.0633 TO 1.64446e+007
Date: Mon Feb 01 10:12:24 2021
Total elapsed time: 0.197 seconds.
tnom = 27
temp = 27
method = trap
totiter = 5
traniter = 0
tranpoints = 0
accept = 0
rejected = 0
matrix size = 9
fillins = 0
solver = Normal
Matrix Compiler1: 23 opcodes
Matrix Compiler2: 667 bytes object code size
Vedant Kelka
AC Lab 4 191205
Rsig1
1k
CC2
1µF
Vin_Vedant
Vs1
AC 1
.model nmos1 nmos(vto=
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Ready
Type here to search
ENG
10:12
01-02-2021

EX4 Cgd=0.4pf


LTspice XVII - [AC_lab4.asc]
File Edit Hierarchy View Simulate Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
Vedant Kelkar
AC Lab 4 1912052
R1
100k
RD
5k
VCC1
5V
C1
0.4pf
CC1
2µF
D
M1
NMOS1
G
S
Rsig1
1k
CC2
1µF
Vin_Vedant
Vout_Vedant
C2
10pf
Vs1
AC 1
R2
20k
RS
1k
CE1
10µF
RL1
1k
.model nmos1 nmos(vto= 0.5 kp=1e-3 W=2um L=1um lambda=0)
.op
.ac dec 10 1 100Meg
.meas Gain MAX mag(V(Vout_Vedant))
.meas Value3dB param Gain/sqrt(2)
.meas Bandwidth TRIG mag(V(Vout_Vedant))=Value3dB RISE=1 TARG mag(V(Vout_Vedant))=Value3dB FALL=last
Type here to search
ENG
10:13
01-02-2021


LTspice XVII - [AC_lab4.asc]
File View Plot Settings Simulation Tools Window Help
AC2_lab2.asc AC2_lab3.asc AC_lab4.asc AC_lab4.asc
V(vout_vedant)
-5dB
-10dB
-15dB
-20dB
-25dB
-30dB
-35dB
-40dB
-45dB
-50dB
-55dB
1Hz
10Hz
100Hz
1KHz
10KHz
100KHz
1MHz
10MHz
100MHz
x = 8.263KHz y = -38.333dB
Type here to search
ENG
10:13
01-02-2021





When certain parameters change there is a noticeable change in the gain, low frequency, high frequency and the bandwidth.

Suggestions: Kindly add simulation results in the form of table

AC LAB 4 is approved with suggestion: Inderjit Singh Dhanjal