Faculty of Engineering & Technology Electrical & Computer Engineering Department

ENEE2103

CIRCUITS AND ELECTRONICS LABORATORY

Prelab IV

Name and ID : Raghad Afaghani - 1192423

Section : 2

Instructor : Dr. Mohammad Al Ju'beh

Teacher Assistant : Eng. Bilal Ismail

Date :28.5.2023

1.Characteristic of an n-channel JFET:

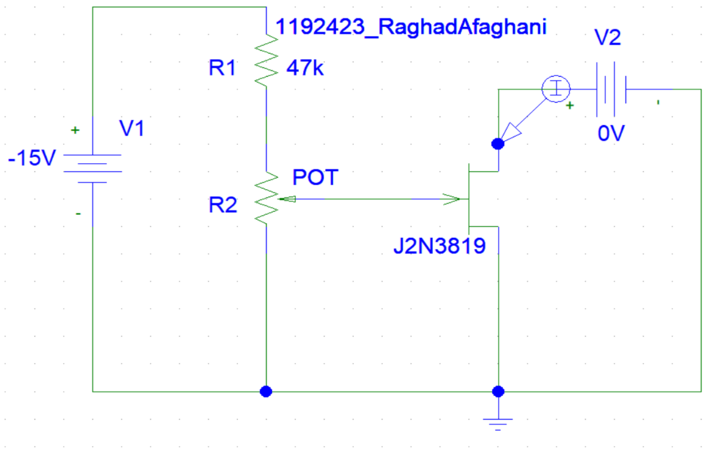


Figure 1. Characteristic of an n-channel JFET

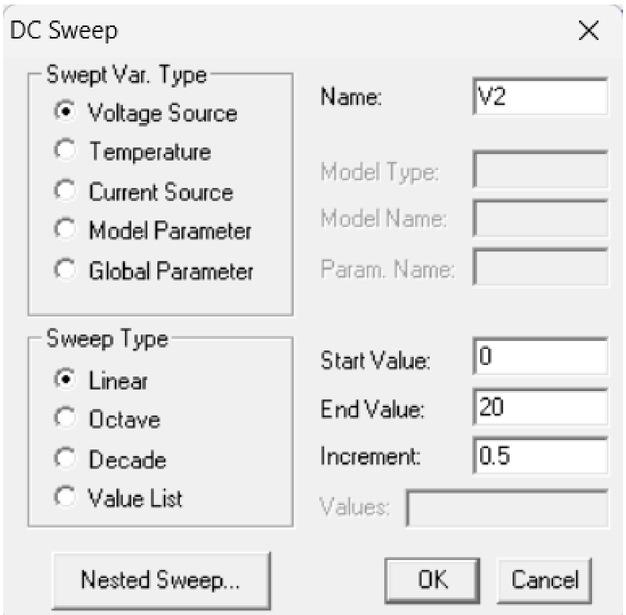


Figure 2. DC Sweep

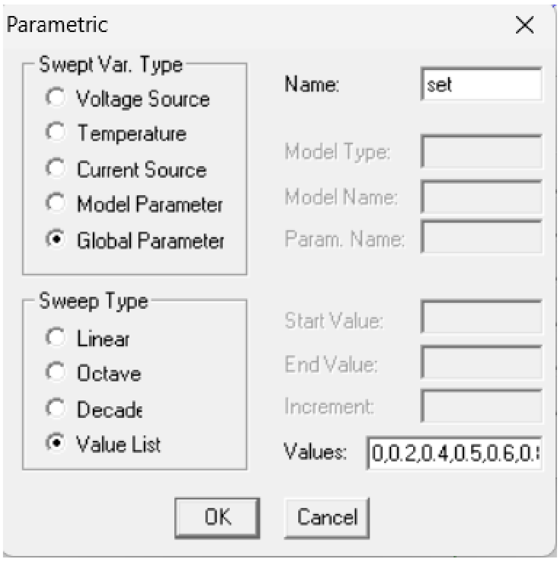


Figure 3. Parametric Values

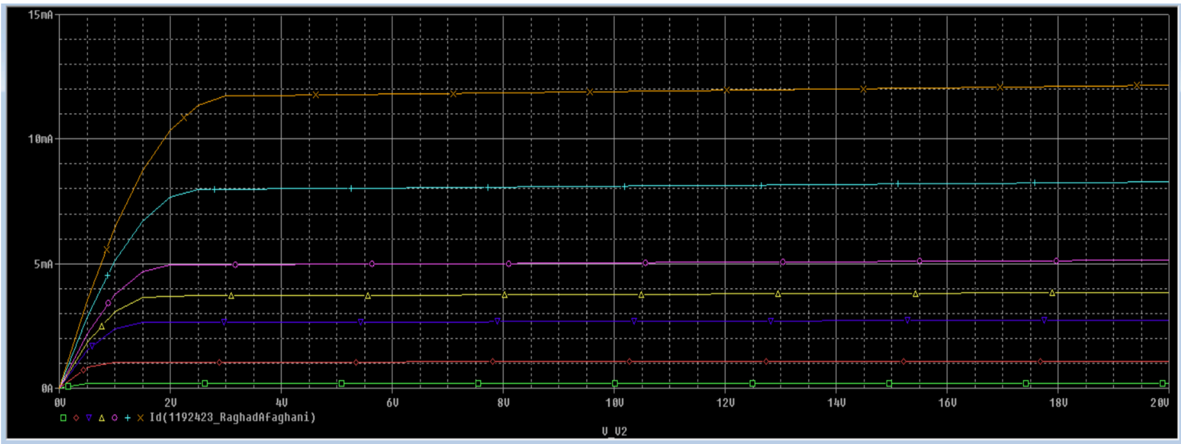


Figure 4. IDS as function of VDS

Questions:

- From your graph, above which values of V_{DS} is I_D almost unaffected by V_{DS} when V_{GS}=0?

When VGS=0 and VDS=2V, the values of ID remain largely unchanged.

- For a given value of V_{DS}, (say 10 V), do equal changes of V_{GS} cause equal changes of I_D?

Junction between the source and gate Reverse bias junction so the value of Id is too small close to zero

- Can you measure I_G or is it too small?

It is not possible to measure IG as it is an extremely small quantity.

- From your graph, estimate the change in I_D for 0.5 change in V_{GS} when V_{DS} =10 V, and V_{GS} -1.0 V, then find the transconductance of the transistor(g_m).

Transconductance = g_m = (change in I_D) / (change in V_{GS}) = $\frac{2\times I_{DS}}{V_{DS}} \times (1 - \frac{V_{GS}}{V_{DS}})$ =

$\frac{2\times 3.5459}{1.5} \times (1 - \frac{-1}{1.5})$ = 7.87978.

2.Common Drain Amplifier Circuit

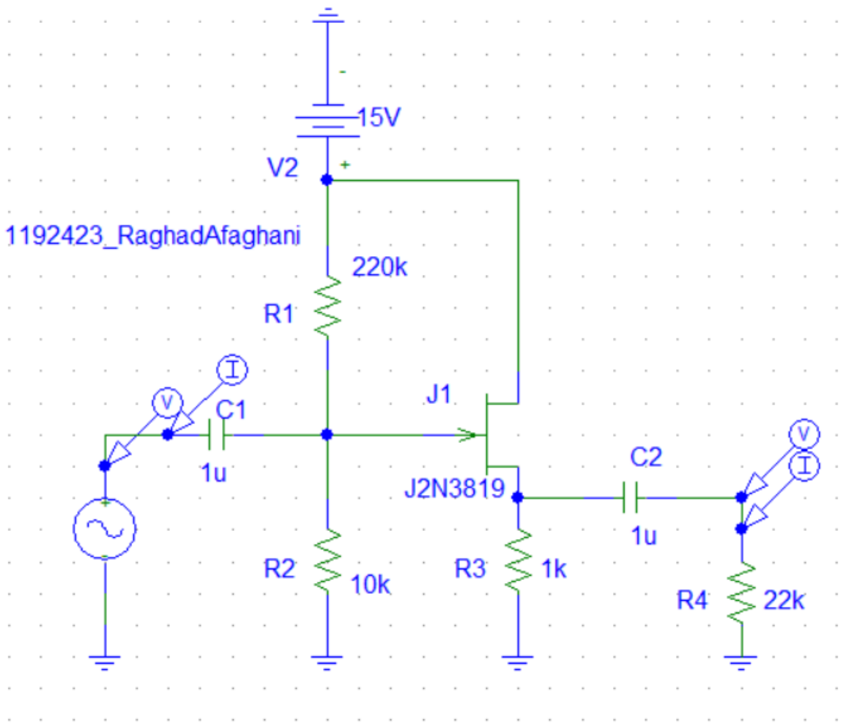


Figure 5. Common Drain Amplifier Circuit

1.Conduct a bias point analysis and measure the DC voltages of VG and VS.

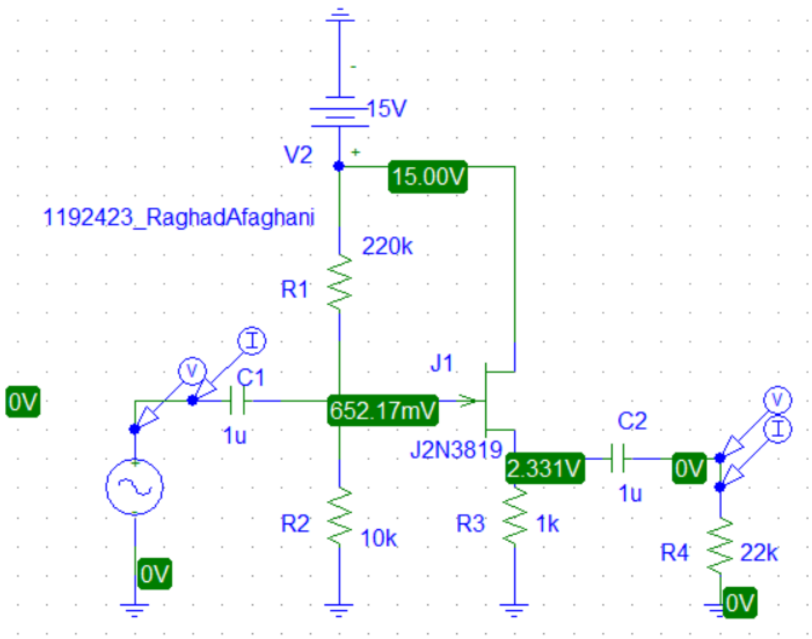
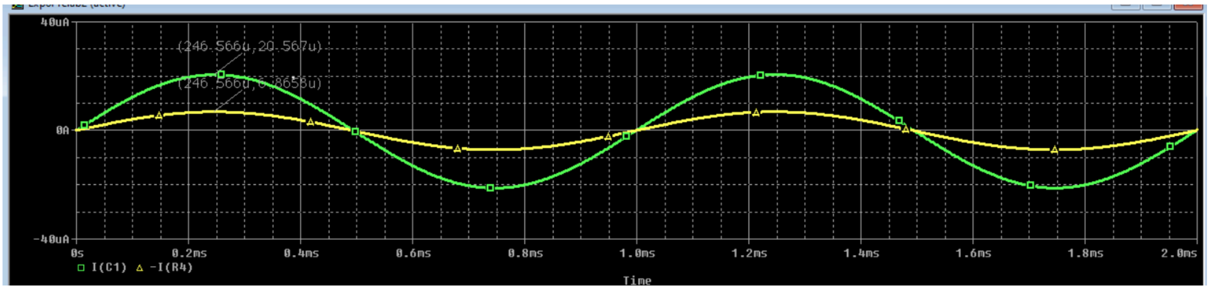
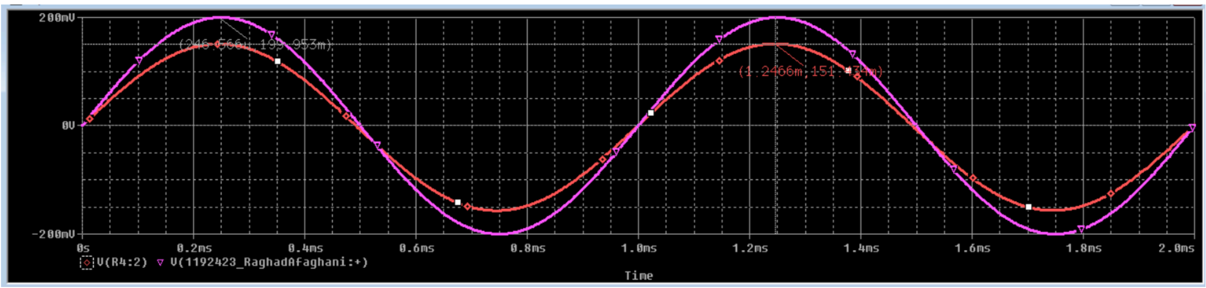


Figure 6. DC voltages of VG&VS

- The simulation result shows that Vg is 652.17mV and Vs is 2.331V.
- To calculate Vg using the voltage divider rule:
  - $\frac{R2}{R2+R1} * V_2 = \frac{10k}{10k+220k} * 15 = 652.5mV.$

2. Apply a 0.4-volt peak-to-peak input with a frequency of 1 kHz from the generator, and observe the corresponding input and output currents and voltages.





3.To calculate the voltage gain and phase shift between the input and output voltage:

- The voltage gain (Av) is given by Av = Vout / Vin = 151.434 mV / 199.953 mV = 0.75735.
- The current gain (AI) is given by AI = Iout / Iin = 6.8658 u / 20.567 u = 0.333826.
- The phase shift is given by $\Delta\varphi = \frac{T_{\Delta pp} \times 360}{period} = \frac{(1.2506m - 12506m)\times 360°}{1.0m} = 0°$

4.To determine the values of Zin and Zout using the appropriate voltages and currents at the specified locations in the previous figure:

- The value of Iin is 20.567 uA and the value of Iout is 6.8658 uA.
- Zin is calculated as Vin / Iin = 199.953 mV / 20.567 uA = 9.722030 kΩ.
- Zout is calculated as Vout / Iout = 151.434 mV / 6.8658 uA = 22.056279 kΩ.

3.Constant Current Source

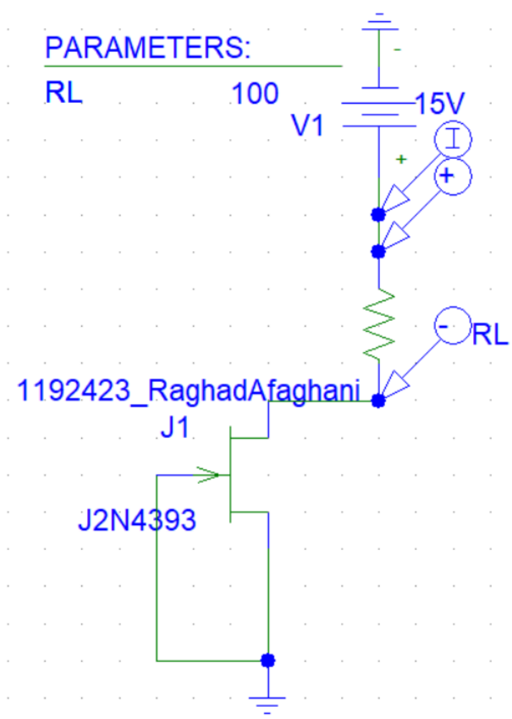


Figure 7. Constant Current Source

1.Conduct a DC sweep for the value of RL within the specified range.

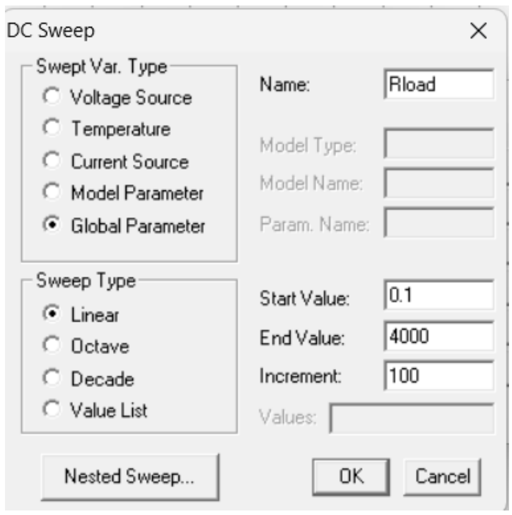
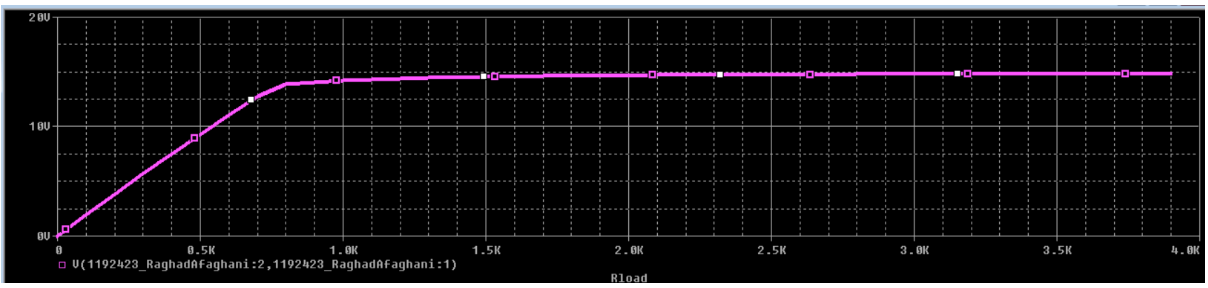
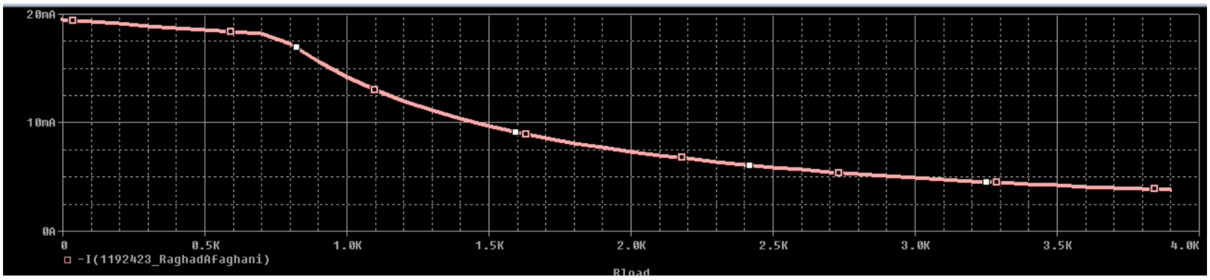


Figure 8. DC sweep for RL Value

2.The plots show the current ID and voltage VL across the resistor RL.





3.Display the voltage VL across the resistor and the current IDS.

R_L(KΩ)	V_L(V)	I_D(mA)
0.1	1.9323	19.323
0.22	4.1959	19.081
0.33	6.2503	18.876
0.47	8.7172	18.607
0.56	10.374	18.444
1	14.224	14.218
1.5	14.537	9.690
2	14.666	7.3228
3	14.785	4.9282

Table 1. VL across the resistor RL and ID