Prelab 11 and 12

7/18/22

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## Part 1: Lab 11

### Table

|  |  |  |  |
| --- | --- | --- | --- |
| V2 = 2.5 | | | |
| Vds | Vgs (mV) | Id (mA) | V1 |
| 0 | 2.475 | 0 | 0 |
| 0.008529 | 2.44 | 0.000356 | 0.4 |
| 0.019 | 2.405 | 0.00071 | 0.8 |
| 0.021 | 2.396 | 0.000799 | 1.1 |
| 0.028 | 2.379 | 0.000975 | 1.4 |
| 0.038 | 2.353 | 0.001238 | 1.7 |
| 0.051 | 2.327 | 0.001499 | 2.5 |
| 0.107 | 2.26 | 0.002176 | 3 |
| 0.215 | 2.225 | 0.002532 | 3.1 |
| 0.312 | 2.224 | 0.002534 | 3.2 |
| 0.412 | 2.224 | 0.002534 | 3.3 |
| 0.512 | 2.224 | 0.002534 | 3.4 |
| V2 = 3 | | | |
| 0 | 2.97 | 0 | 0 |
| 0.005374 | 2.926 | 0.00045 | 0.5 |
| 0.011 | 2.881 | 0.000899 | 1 |
| 0.018 | 2.837 | 0.001347 | 1.5 |
| 0.022 | 2.81 | 0.001616 | 1.8 |
| 0.028 | 2.775 | 0.001974 | 2.2 |
| 0.033 | 2.748 | 0.002243 | 2.5 |
| 0.04 | 2.713 | 0.0026 | 2.9 |
| 0.048 | 2.678 | 0.002956 | 3.3 |
| 0.057 | 2.642 | 0.003311 | 3.7 |
| 0.073 | 2.59 | 0.003842 | 4.3 |
| 0.089 | 2.546 | 0.004282 | 4.8 |
| 0.124 | 2.477 | 0.004978 | 5.6 |
| 0.19 | 2.402 | 0.005736 | 6.5 |
| 0.266 | 2.364 | 0.006121 | 7 |
| 0.294 | 2.358 | 0.006187 | 7.1 |
| 0.338 | 2.353 | 0.006238 | 7.2 |
| 0.432 | 2.352 | 0.006243 | 7.3 |
| 0.532 | 2.352 | 0.006243 | 7.4 |
| V2 = 3.5 | | | |
| 0 | 3.465 | 0 | 0 |
| 0.003699 | 3.421 | 0.000451 | 0.5 |
| 0.007609 | 3.376 | 0.000902 | 1 |
| 0.012 | 3.331 | 0.001353 | 1.5 |
| 0.016 | 3.287 | 0.001803 | 2 |
| 0.021 | 3.242 | 0.002254 | 2.5 |
| 0.026 | 3.198 | 0.002704 | 3 |
| 0.031 | 3.153 | 0.003153 | 3.5 |
| 0.037 | 3.109 | 0.003603 | 4 |
| 0.043 | 3.064 | 0.004051 | 4.5 |
| 0.05 | 3.02 | 0.0045 | 5 |
| 0.058 | 2.975 | 0.004947 | 5.5 |
| 0.066 | 2.931 | 0.005395 | 6 |
| 0.069 | 2.914 | 0.005573 | 6.2 |
| 0.075 | 2.887 | 0.005841 | 6.5 |
| 0.081 | 2.861 | 0.006108 | 6.8 |
| 0.085 | 2.843 | 0.006286 | 7 |
| 0.09 | 2.825 | 0.006464 | 7.2 |
| 0.097 | 2.799 | 0.00673 | 7.5 |
| 0.0104 | 2.773 | 0.006996 | 7.8 |
| 0.11 | 2.755 | 0.007173 | 8 |
| 0.115 | 2.738 | 0.007349 | 8.2 |
| 0.125 | 2.711 | 0.007614 | 8.5 |
| 0.135 | 2.685 | 0.007877 | 8.8 |
| 0.143 | 2.668 | 0.008052 | 9 |
| 0.151 | 2.651 | 0.008227 | 9.2 |
| 0.164 | 2.625 | 0.008487 | 9.5 |
| 0.179 | 2.599 | 0.008746 | 9.8 |
| 0.19 | 2.582 | 0.008918 | 10 |
| 0.203 | 2.566 | 0.009088 | 10.2 |
| 0.225 | 2.541 | 0.009341 | 10.5 |
| 0.252 | 2.516 | 0.009589 | 10.8 |
| 0.274 | 2.5 | 0.00975 | 11 |
| 0.337 | 2.47 | 0.01 | 11.4 |
| 0.361 | 2.463 | 0.01 | 11.5 |
| 0.5 |  | 0.01 |  |
| V2 = 4 | | | |
| 0 | 3.96 | 0 | 0 |
| 0.002887 | 3.916 | 0.000452 | 0.5 |
| 0.005889 | 3.871 | 0.000904 | 1 |
| 0.009014 | 3.826 | 0.001355 | 1.5 |
| 0.012 | 3.781 | 0.001807 | 2 |
| 0.016 | 3.737 | 0.002258 | 2.5 |
| 0.019 | 3.692 | 0.00271 | 3 |
| 0.023 | 3.647 | 0.003161 | 3.5 |
| 0.027 | 3.603 | 0.003612 | 4 |
| 0.0031 | 3.558 | 0.004063 | 4.5 |
| 0.035 | 3.514 | 0.004513 | 5 |
| 0.04 | 3.469 | 0.004964 | 5.5 |
| 0.043 | 3.442 | 0.005234 | 5.8 |
| 0.045 | 3.424 | 0.005414 | 6 |
| 0.05 | 3.38 | 0.005864 | 6.5 |
| 0.055 | 3.335 | 0.006313 | 7 |
| 0.058 | 3.317 | 0.006493 | 7.2 |
| 0.061 | 3.291 | 0.006762 | 7.5 |
| 0.067 | 3.246 | 0.007211 | 8 |
| 0.07 | 3.229 | 0.007391 | 8.2 |
| 0.074 | 3.202 | 0.00766 | 8.5 |
| 0.082 | 3.158 | 0.008108 | 9 |
| 0.085 | 3.14 | 0.008287 | 9.2 |
| 0.089 | 3.113 | 0.008555 | 9.5 |
| 0.094 | 3.087 | 0.008823 | 9.8 |
| 0.098 | 3.069 | 0.009002 | 10 |
| 0.102 | 3.051 | 0.00918 | 10.2 |
| 0.107 | 3.025 | 0.009448 | 10.5 |
| 0.113 | 2.998 | 0.009715 | 10.8 |
| 0.118 | 2.981 | 0.009893 | 11 |
| 0.122 | 2.963 | 0.01 | 11.2 |
| 0.129 | 2.937 | 0.01 | 11.5 |
| 0.25 |  | 0.01 |  |
| 0.4 |  | 0.01 |  |
| 0.55 |  | 0.01 |  |

**Table 2.**

|  |  |
| --- | --- |
| Vgs | Id (mA) |
| 1.98 | 0.003553 |
| 2.136 | 0.931 |
| 2.224 | 2.537 |
| 2.293 | 4.338 |
| 2.352 | 6.244 |
| 2.404 | 8.219 |
| 2.451 | 10 |
| 2.494 | 12 |
| 2.535 | 14 |
| 2.573 | 17 |
| 2.609 | 19 |
| 2.755 | 20 |
| 2.992 | 20 |

Multisim

Diagram, schematic

Description automatically generated

**Figure 1.** Lab 11 circuit

### Plot

The blue line marks the saturation region.

**Figure 2.** Characteristic curves

**Figure 3.** Id v Vgs

## Part 2: Lab 8

Diagram, schematic

Description automatically generated

**Figure 4.** MOSFET Amplification Circuit

### Table

|  |  |  |
| --- | --- | --- |
| F(HZ) | VOUT | Gain(db) |
| 10 | 0.02135 | -13.4120424 |
| 30 | 0.06591 | -3.62097377 |
| 60 | 0.126 | 2.007410902 |
| 100 | 0.192 | 5.666024574 |
| 200 | 0.286 | 9.127320663 |
| 1k | 0.368 | 11.31695637 |
| 2k | 0.372 | 11.4108588 |
| 5k | 0.37 | 11.36403448 |
| 10k | 0.372 | 11.4108588 |
| 15k | 0.372 | 11.4108588 |
| 20k | 0.371 | 11.38747819 |
| 50k | 0.363 | 11.1981325 |
| 75k | 0.352 | 10.93085327 |
| 100k | 0.338 | 10.57833401 |
| 150k | 0.305 | 9.685996787 |
| 200k | 0.271 | 8.659385817 |
| 500k | 0.145 | 3.227360045 |
| 750k | 0.102 | 0.172003435 |
| 1M | 0.07789 | -2.17036592 |
| 1.5M | 0.0534 | -5.44917486 |
| 2M | 0.04295 | -7.34073664 |
| 3M | 0.02952 | -10.5976729 |

Gain:20\*Log( Vout/100mV)

Vout is V(p-p)

Slightly out of phase, more in phase around 2k

Divide highest gain by sq(2) for bandwidth which gives 8.

### Plot

**Figure 4.** Plot of Gain

### Output Waveforms

Graphical user interface

Description automatically generated

**Figure 5.** 10 Hz waveform Output

Chart

Description automatically generated

**Figure .** 3M Hz Output Waveform