Lab exercise 7 Name: _____

We will perform this lab in a simulator. Multisim should be adequate.

Note: Feel free to use and modify a demo circuit of inverting amplifier located at https://www.multisim.com/content/YnxbaSr7a2q6XZGsYoQUbj/ideal-inverting-amplifier/

Task 1

Take a generator with the sinusoidal output, 1 kHz frequency, peak amplitude 0.1 V, and zero DC offset. Connect it to a voltage divider constructed of the two resistors of equal resistance $R = 1$ kΩ. Confirm (i.e. make necessary measurements) that the output impedance of this voltage divider is $R/2$.

Task 2

Construct a buffer or follower operational amplifier circuit (for simplicity use 3 Terminal Opamp from Multisim, i.e. do not worry about power supply lines).

Connect your follower to the voltage divider from the previous task. Prove that it works as expected for large load resistors (> 100 Ω).

Find the maximum current which this opamp can source. To do so, start connecting smaller and smaller load resistors. At some point, you will see that the output voltage drop becomes clipped because the opamp cannot source enough current to provide proper voltage drop on the load resistor. Note: the multisim model allows to source unrealistically large currents, but after all it is just a model not a real thing.

Task 3

Construct an inverting amplifier with the gain of -1 and connect it to your voltage divider. Keep the feedback resistor below 1 kΩ. Set your load resistor to a high value, so the output is not clipped or saturated.

Is the output is what you expected or smaller in amplitude? This is probably related to the input impedance of the inverting amplifier. What is it?

Once you take in account the input impedance, is the output matches your expectations?

Problem 4

Modify the circuit to increase the inverting gain of your circuit to -100. Make the load resistor high again.

Start to increase your signal generator output, make it larger and larger. You will notice the output voltage will be clipped again. This time, it is due to the fact that we reached the power supply rail. The maximum reachable output voltage is equal to the power supply voltage. What is its value?

Problem 5

Reduce the amplitude of the function generator to 0.1 V. Now play with the frequency of the function generator. Observe that at some quite high frequency the output of your circuit start to decrease. Estimate the gain bandwidth product of your opamp.