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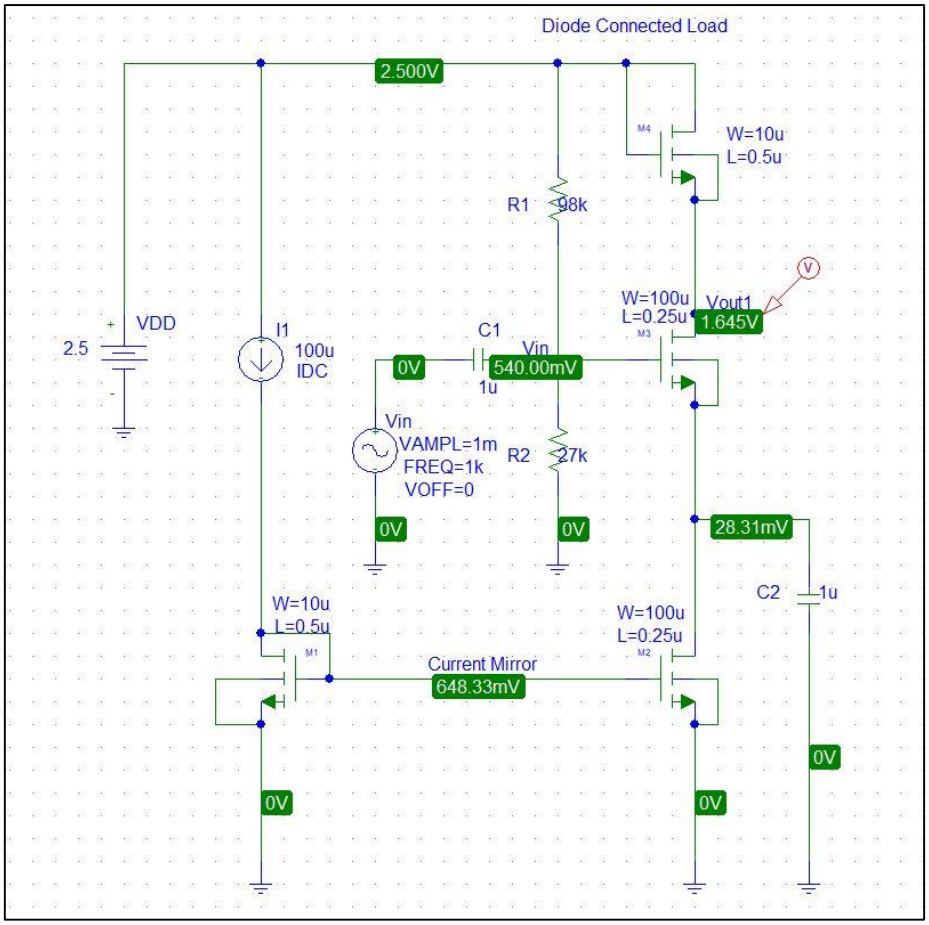
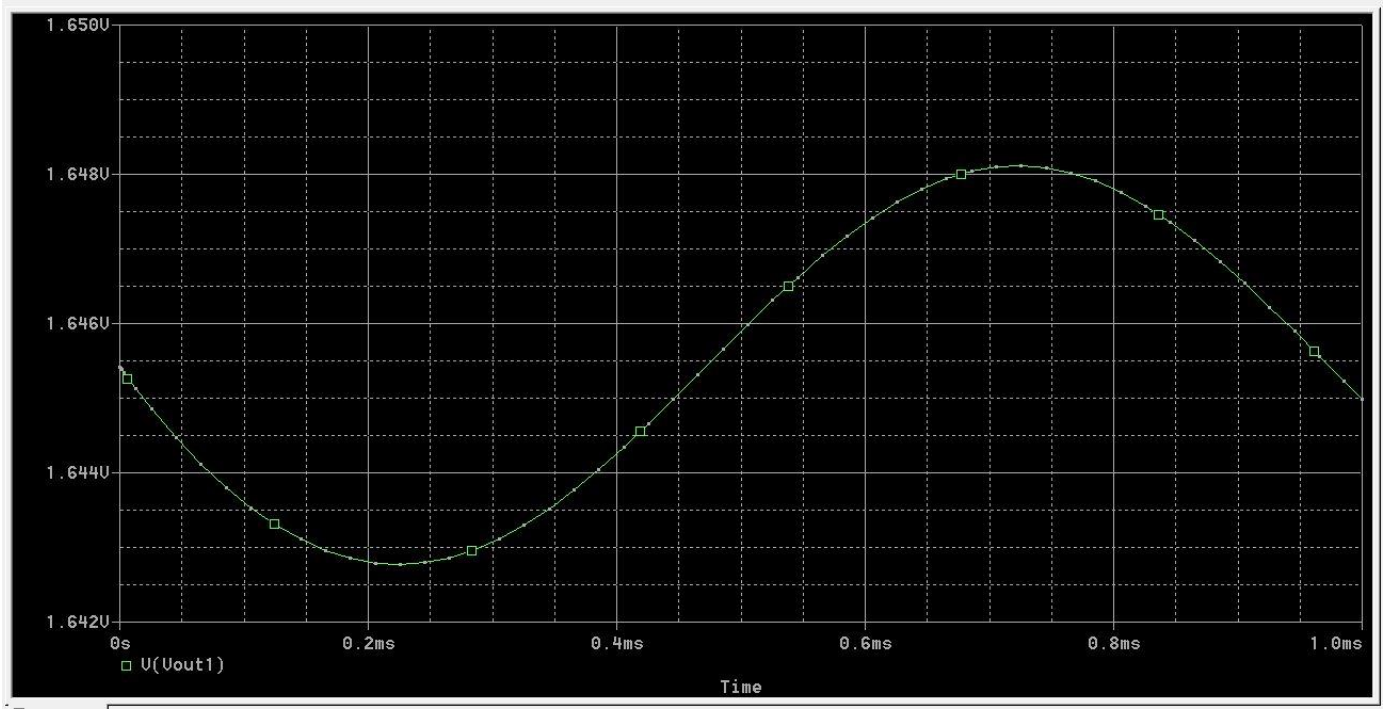
2019142208

Electronic Circuits 1 Project 2

Problem 1

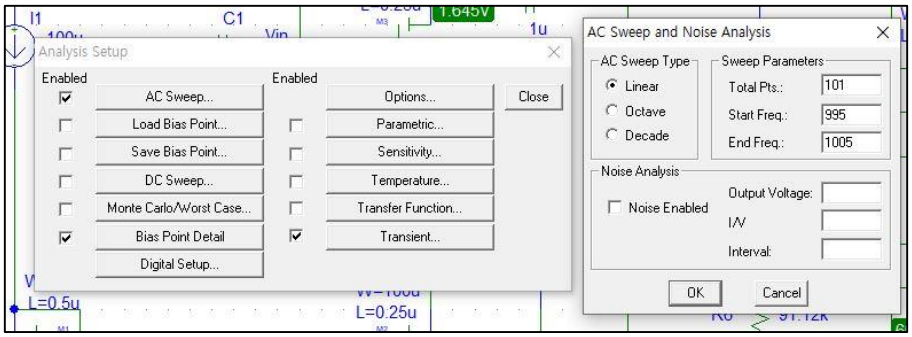
The screenshot of the schematic for this problem is shown below. The transient graph is shown below.



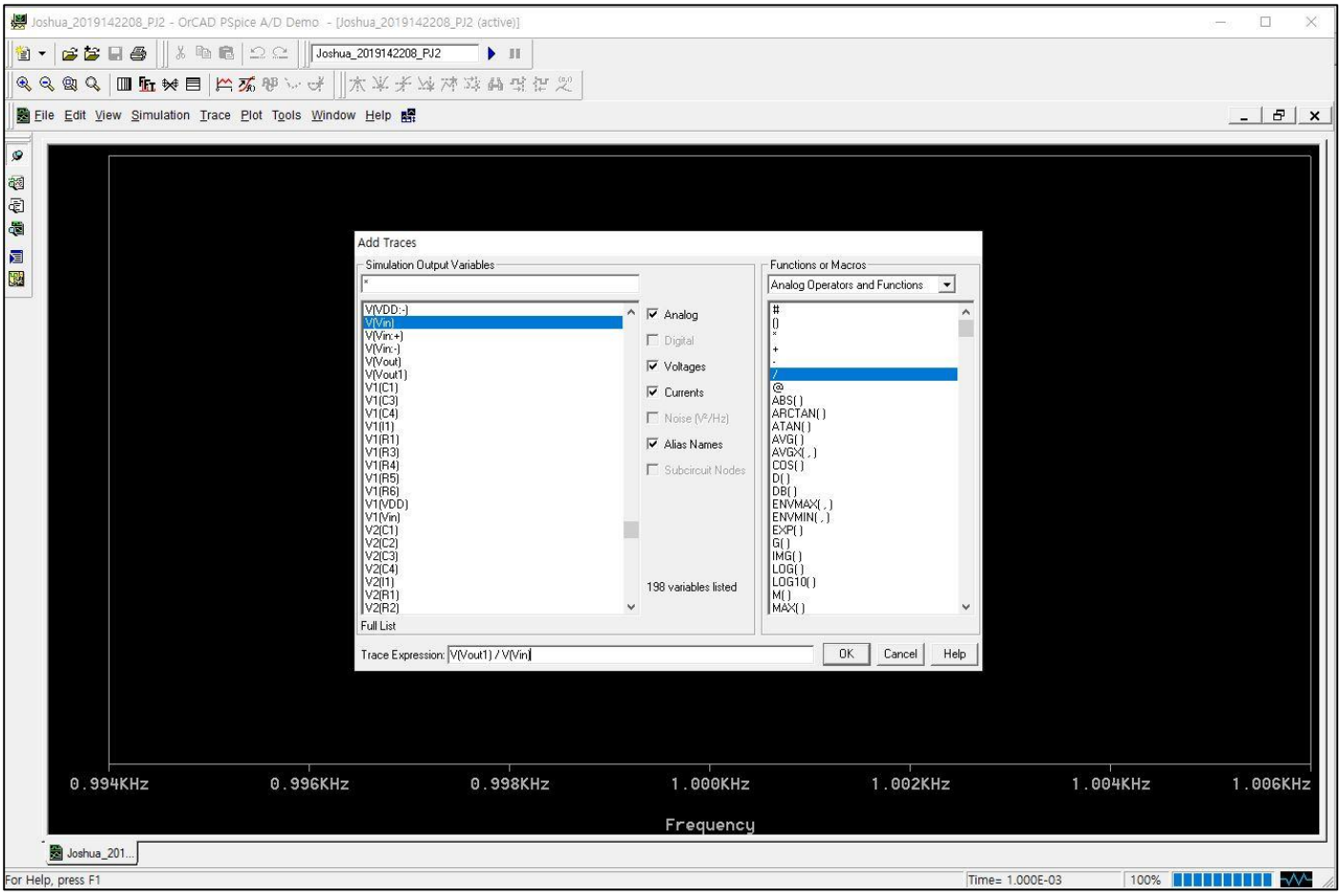


To calculate for the voltage gain, we use AC Sweep Analysis. Although AC sweep analysis is commonly used for analyzing circuit parameters with changing AC signal frequency, we can use this technique as it allows us to analyze small signals (AC) and isolate DC signals on the circuit. We analyze the circuit at 1000 Hz to obtain desired values. The steps on how to perform this are as follow.

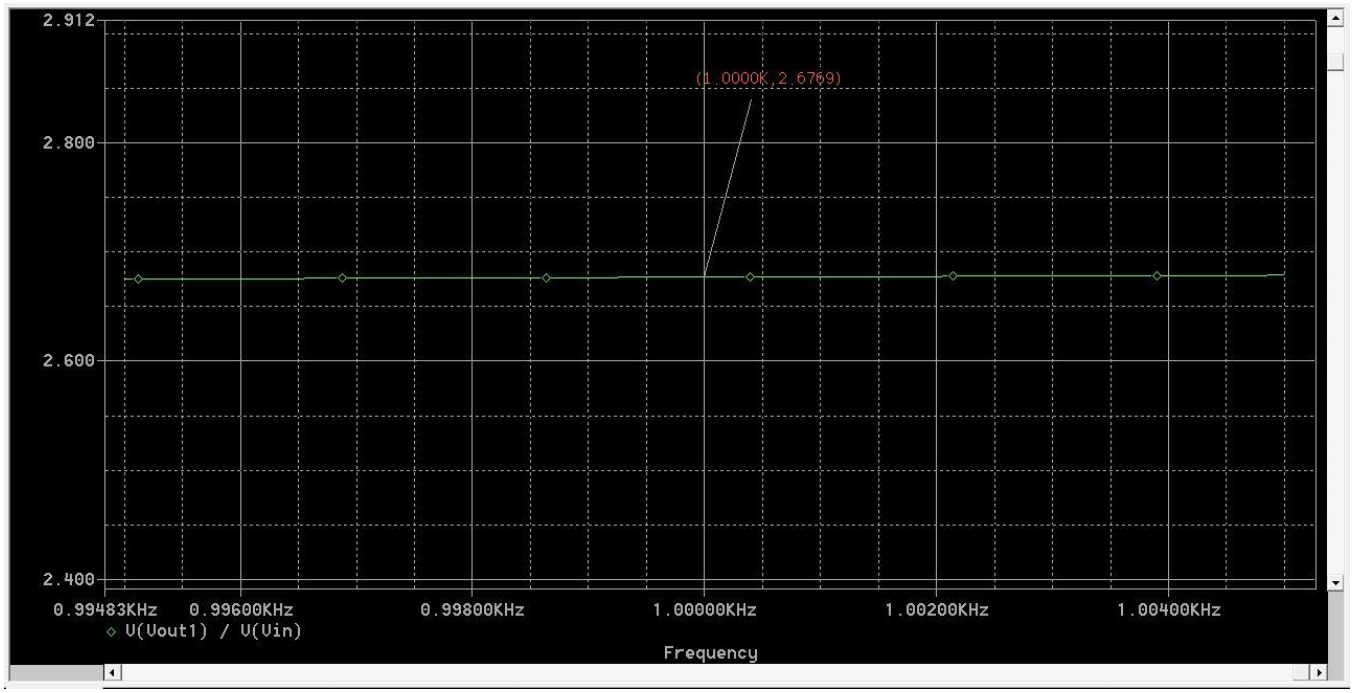
1. We set up the AC sweep analysis simulation on the analysis setup.



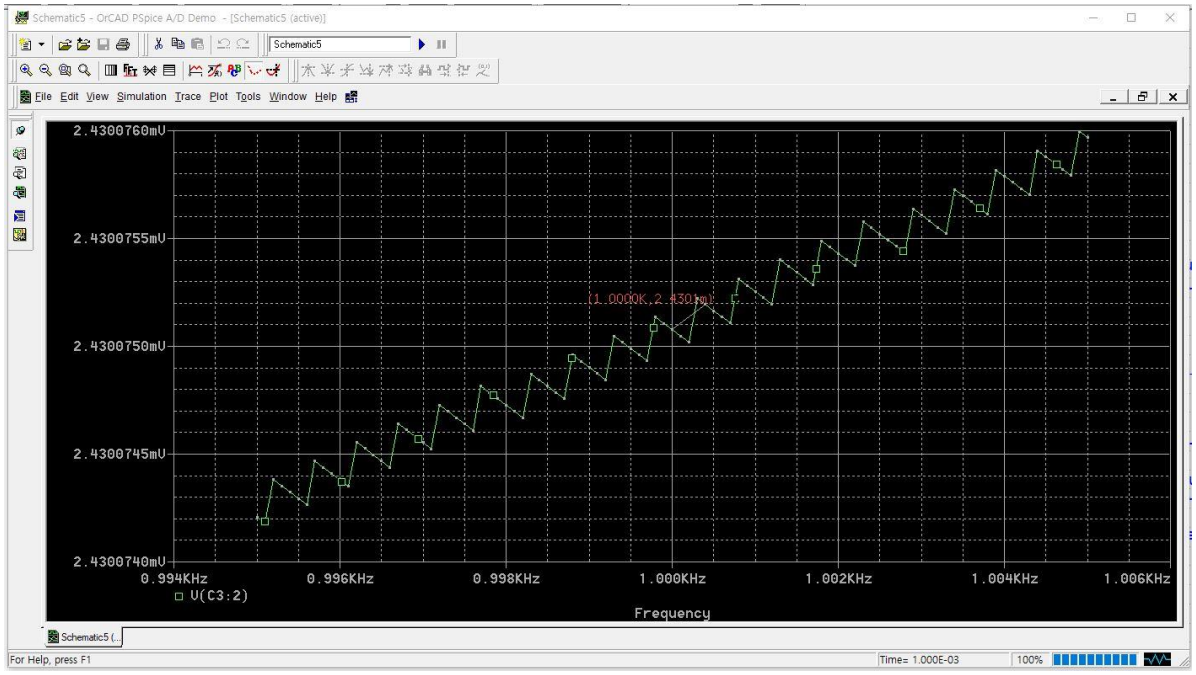
2. We remove all traces on graph and add trace such that we divide Vout1 by Vin.



3. Once the trace is plotted, we hover over to 1000 Hz line and obtain value on the graph. As we can see on the figure below, **the AC signal gain at the output port of the Diode Connected Load stage is 2.6769**, which is above the minimum requirement of 2.5.

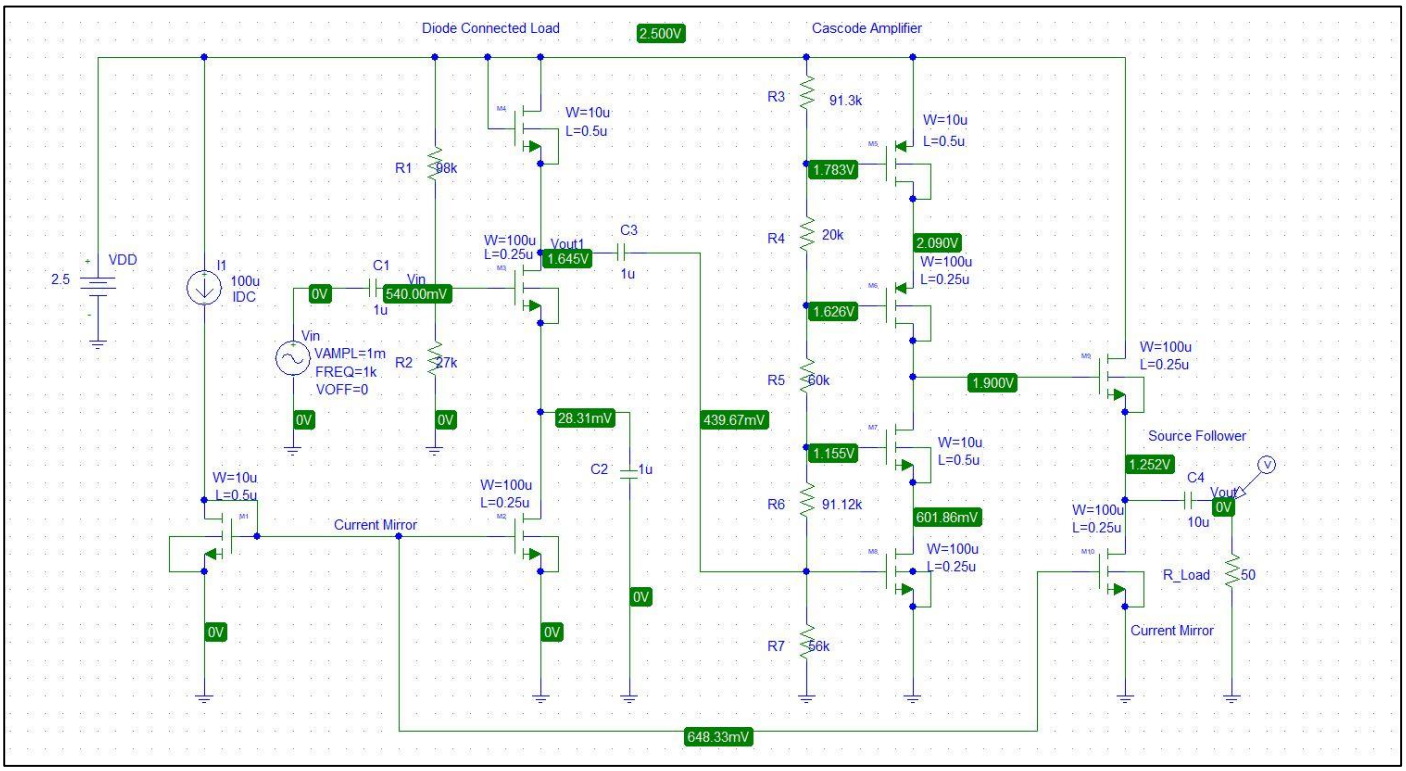


We notice that there is a capacitor (C2) between the diode connected stage and the current mirror. By adding this capacitor, we allow the small signal model to avoid the current mirror M3 on the source side of M2 as M3 acts as a degenerative resistor which lowers the gain. This can be shown by the result of the AC sweep when we remove the C2 capacitor.

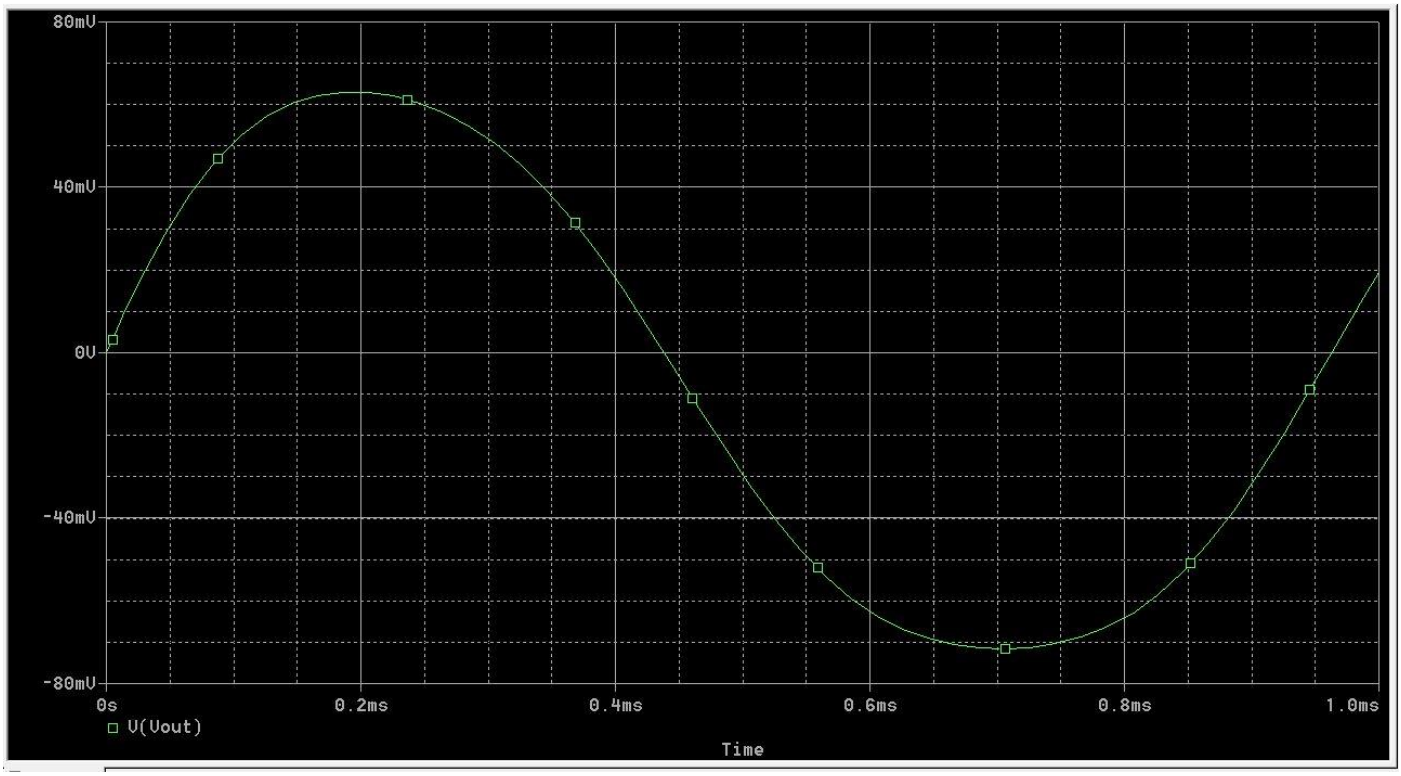


Problem 2

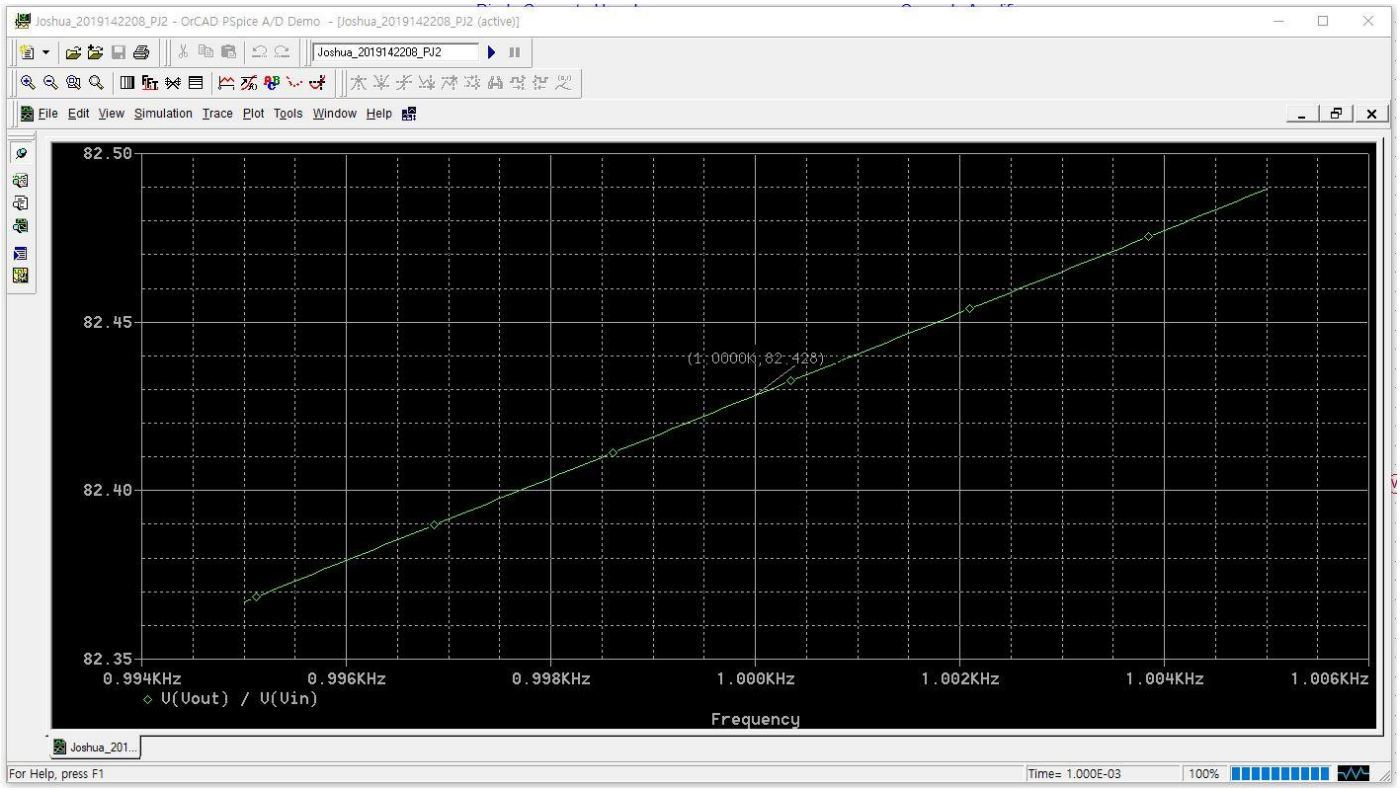
The following figure shows the schematic with the appropriate values for the resistors, and the W/L values of the transistors, and the DC bias at nodes.



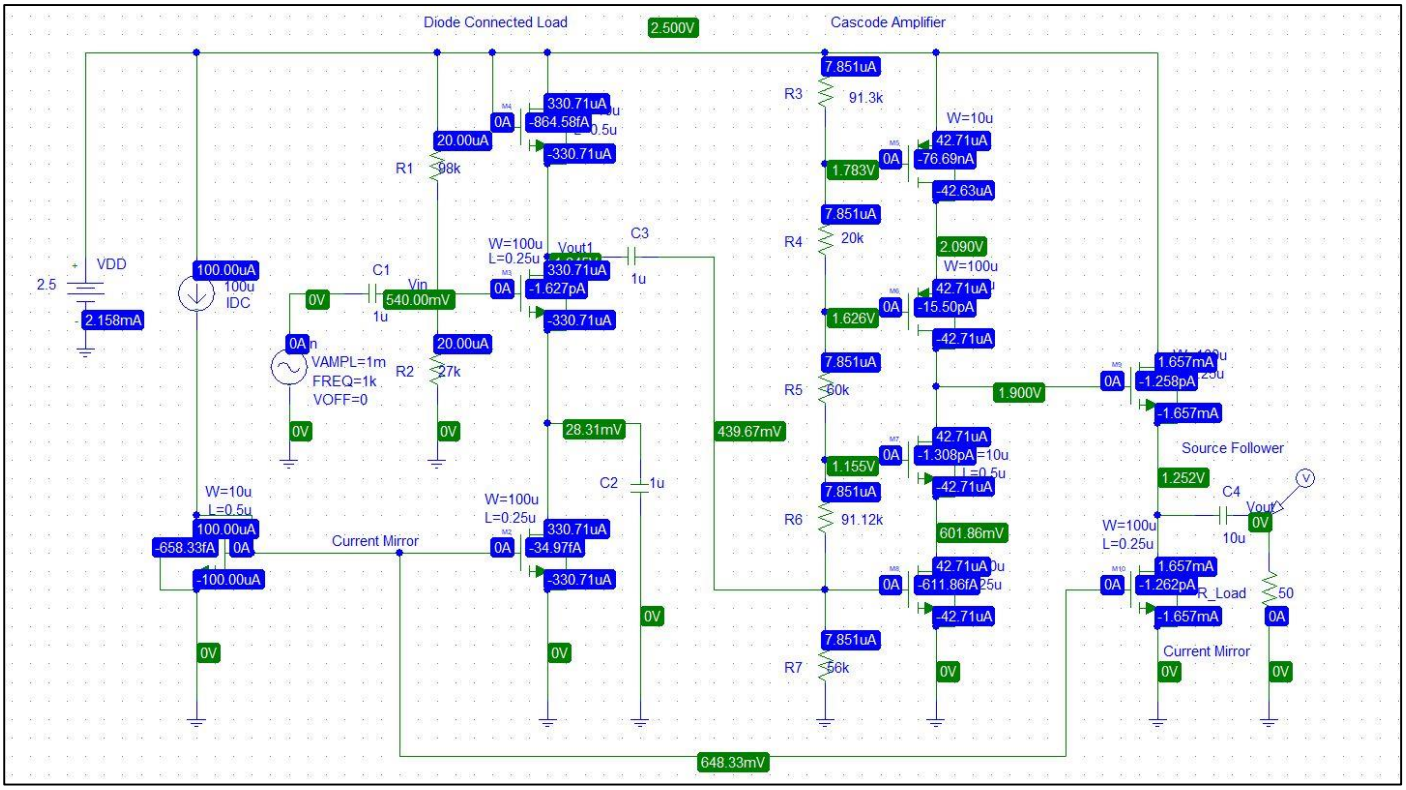
The resulting transient graph at the Vout is shown below.



The result of the AC sweep analysis is shown below.



From the graph, we can see at 1000 Hz, **the small signal gain is 84.428** which is above the minimum requirement of 50. To check the power consumption, we check the DC currents on the wires. The figure below shows the currents.



As we can see, with 2.158 mA current at VDD, the **total power consumption of this entire circuit is 5.4 mW**, which is below limit of 6 mW.