

ECED 3202

LAB #6

BUILD AND TEST Multistage amplifiers

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Problem Statement:

It is required to build the multistage amplifier circuit designed in the previous lab to drive sound from an 8ohm speaker. Furthermore, the purpose of the lab includes learning about power management and dissipation considerations in a real-world circuit.

Architectural Requirements:

- Circuit should be powered by a 5V supply.
- The circuit has to drive an 8ohm speaker load coupled to the amplifier through a 100uF capacitor.

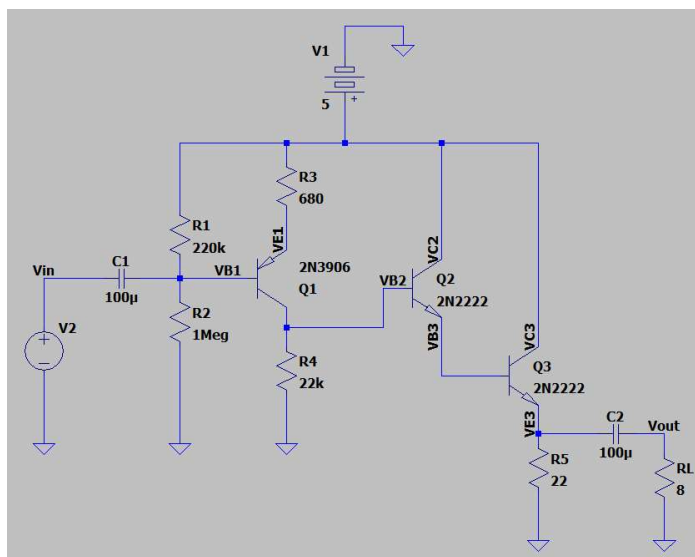
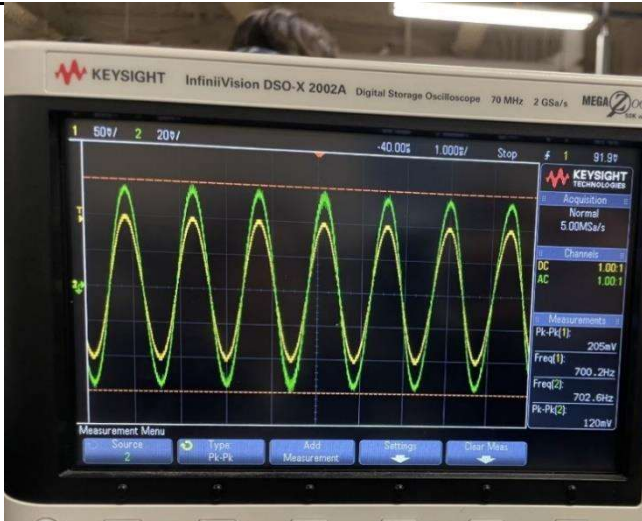
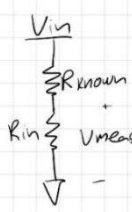


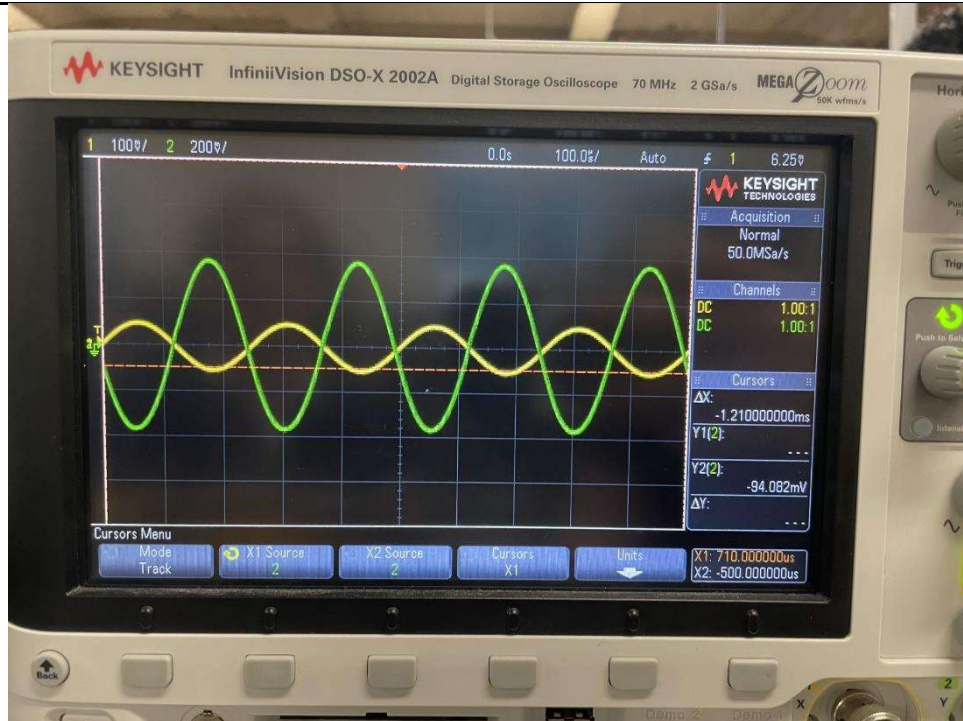
Figure 1: Schematics of circuit to build

Performance Requirements

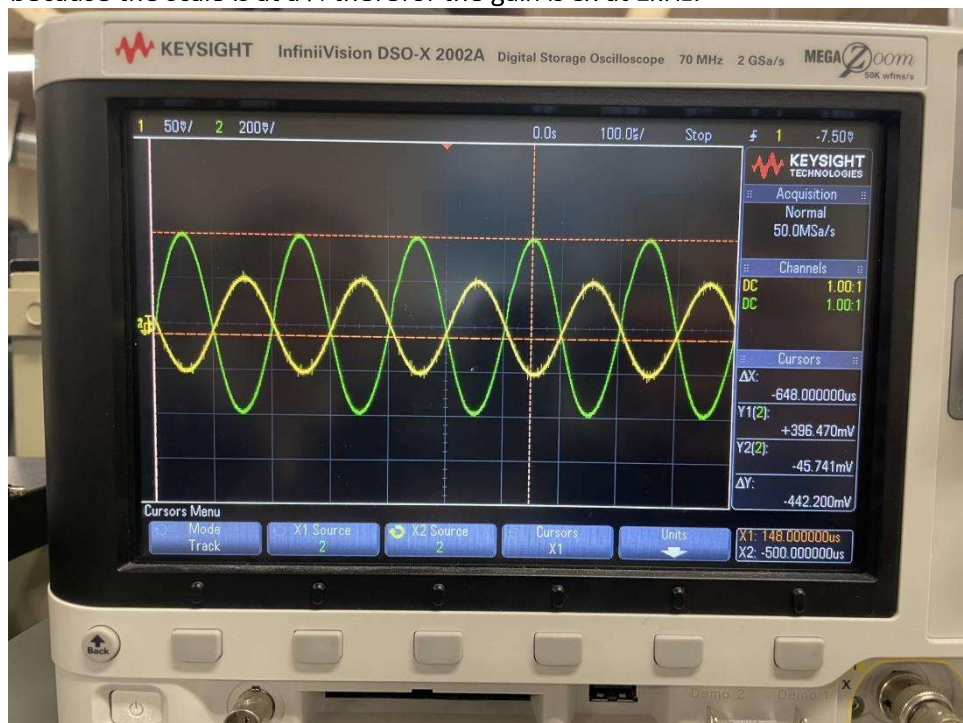
Test R6-03	
Requirements being tested	The input impedance of the amplifier shall be $\geq 80 \text{ k}\Omega$ between 500Hz and 5kHz
Output files	N/A
Description of simulation Configuration	In the simulation, similar values were used to achieve an input impedance gain of over 80k ohm over a frequency range of 500Hz to 5kHz which was successful.
Description of test output	A 205 mV p-p signal was sent through a circuit containing a resistor of known value in series with the amplifier and a voltage drop was measured. The Rin was then calculated through a modified version of voltage divider.
Acceptance Criterion	Input impedance was greater than 80k ohm over a frequency range of 500Hz to 5kHz
Test Result	Calculations show an input impedance of around 140kohm
Objective Evidence	

	 $V_{meas} = V_{in} \frac{R_{in}}{R_{known} + R_{in}}$ $R_{in} \frac{V_{in}}{V_{meas}} = R_{known} + R_{in}$ $R_{in} \left(\frac{V_{in}}{V_{meas}} - 1 \right) = R_{known}$ $R_{in} = \frac{R_{known}}{\frac{V_{in}}{V_{meas}} - 1}$ <p>we know $R_{known} = 100\text{ k}$ $V_{in} = 205\text{ mV P-P}$ $V_{meas} = 120\text{ mV P-P}$</p> <p>so $R_{in} = \frac{100 \times 10^3}{\frac{205}{120} - 1}$</p> <p>$R_{in} = 141176\text{ }\Omega$ which is greater than $80\text{ k}\Omega$</p>
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Test R6-05	
Requirements being tested	The gain of the amplifier shall be 8x over the frequency range from 1000Hz to 5kHz
Output files	Test3.asc submitted in submission.
Description of simulation Configuration	In the simulation, very similar values were used to achieve a gain of over 15x over a frequency range of 500Hz to 5kHz. This was successful and what lab six's values are based off of.
Description of test output	After ranging the function generator from 1kHz to 5kHz we want to observe a consistent gain of around 8x or 18dB or larger.
Acceptance Criterion	The gain is equal to or above 8x over the ranged of frequencies 1-5kHz
Test Result	After ranging the function generator from 1kHz to 5kHz we were able to observe a consistent gain of around 8x or 18dB or larger.
Objective Evidence	1kHz wave gain. Yellow wave is signal from signal generator. Green signal is from the output of the circuit. The signal appears to only be 4x bigger, this is because the scale is at a $\frac{1}{2}$ therefor the gain is 8x at 1kHz.



5kHz wave gain below. Yellow wave is signal from signal generator. Green signal is from the output of the circuit. The signal appears to only be 2x bigger, this is because the scale is at a $\frac{1}{4}$ therefore the gain is 8x at 1kHz.



Test R6-06	
Requirements being tested	The amplifier shall produce audible sound output. This is verified by the video attached.
Output files	

Description of simulation Configuration	N/A
Description of test output	N/A
Acceptance Criterion	Video is audible and clear music can be heard
Test Result	After playing music from an ipad Audio jack music was audible
Objective Evidence	Attached in the video