

ECE 321 - Homework #1

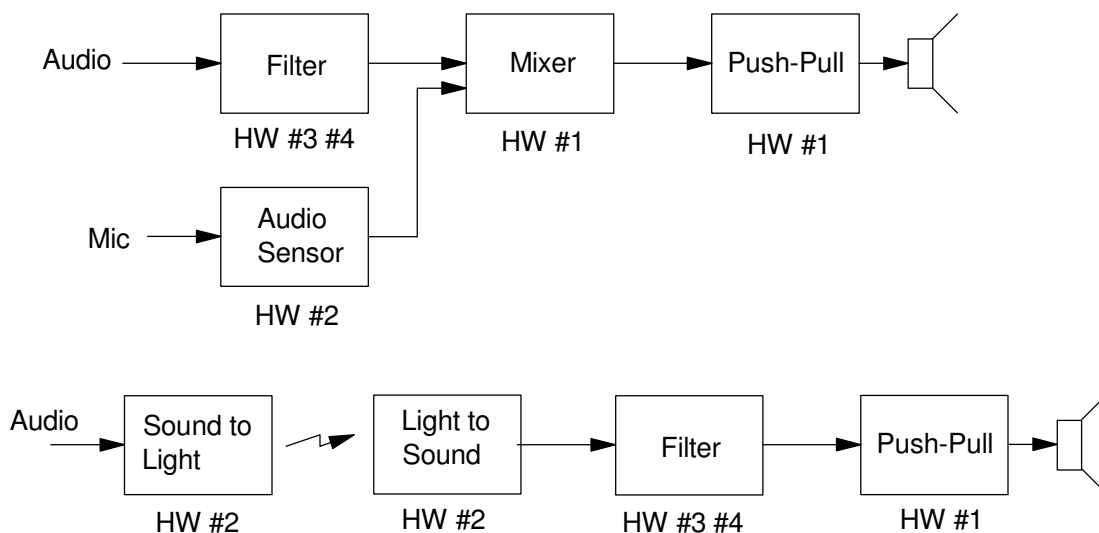
Op Amp Amplifiers, Push-Pull Amplifiers. Due Monday, April 4th

Please make the subject "ECE 321 HW#1" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

1) Pick an amplifier to build for ECE 321 Analog Electronics. This amplifier needs to include

- A speaker and a push-pull amplifier (homework #1)
- An amplifier and/or mixer (homework #1),
- A sensor (light, audio, temperature / 555 timer) and
- A filter (homework #3 and #4),

Some suggestions are...



For all problems, assume you are using

- MCP602 Op Amps (max current = 50mA)
- 2SC6144 transistors ($\beta = 200$, 10A max, $V_{be} = 0.7V$), or
- TIP112 / TIP117 NPN and PNP power transistors (for a push-pull amplifier).
 - $\beta = 1000$, 3A max, $V_{be} = 1.4V$

Amplifier:

Design a circuit to implement

2a) $Y = +6X$

2b) $Y = -6X$

2c) $Y = 12 - 6X$

Mixer

3) Design a circuit to mix three signals together:

- $Y = 3A + 7B + 2C$

Push-Pull Amplifier

4) Design a circuit so that $Y = X$

- $X = -5V$ to $+5V$, 10mA max
- $Y = -5V$ to $+5V$, 200mA (25 ohm speaker (net))

5) Simulate in CircuitLab

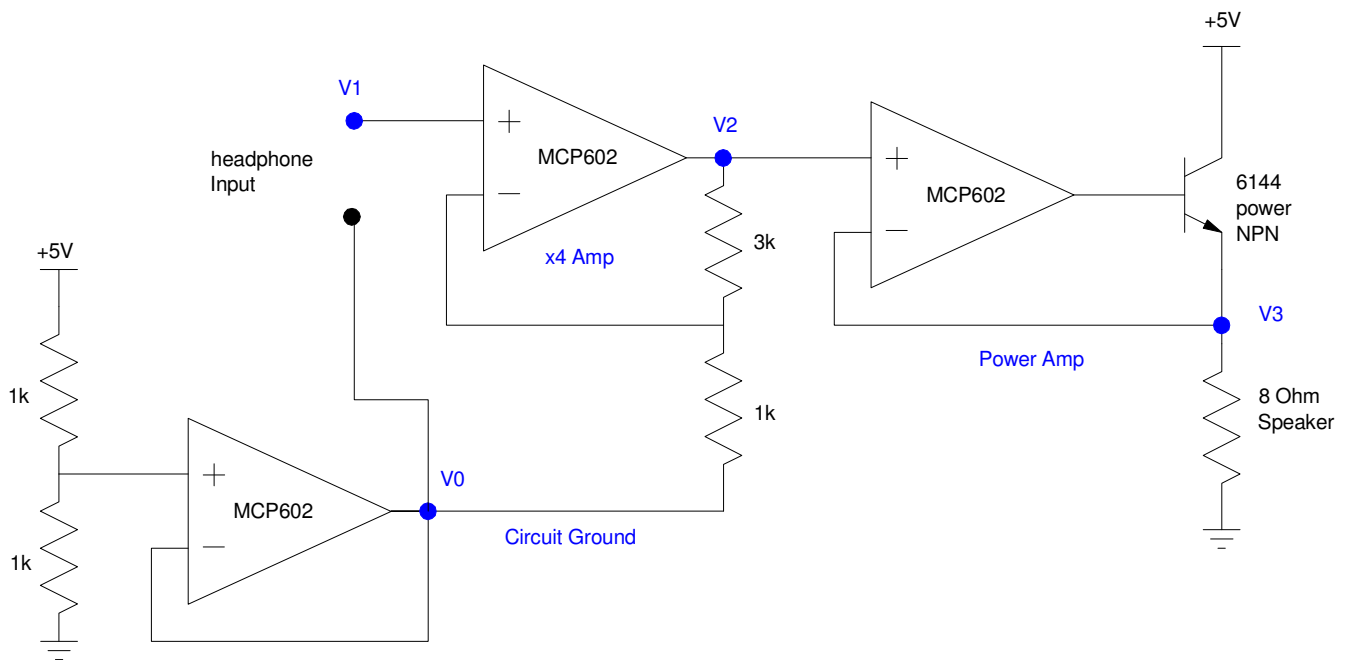
Lab (Hardware) -

Pick one of the following two circuits depending on whether you have a single +5V power supply or dual +6V/-6V power supplies available

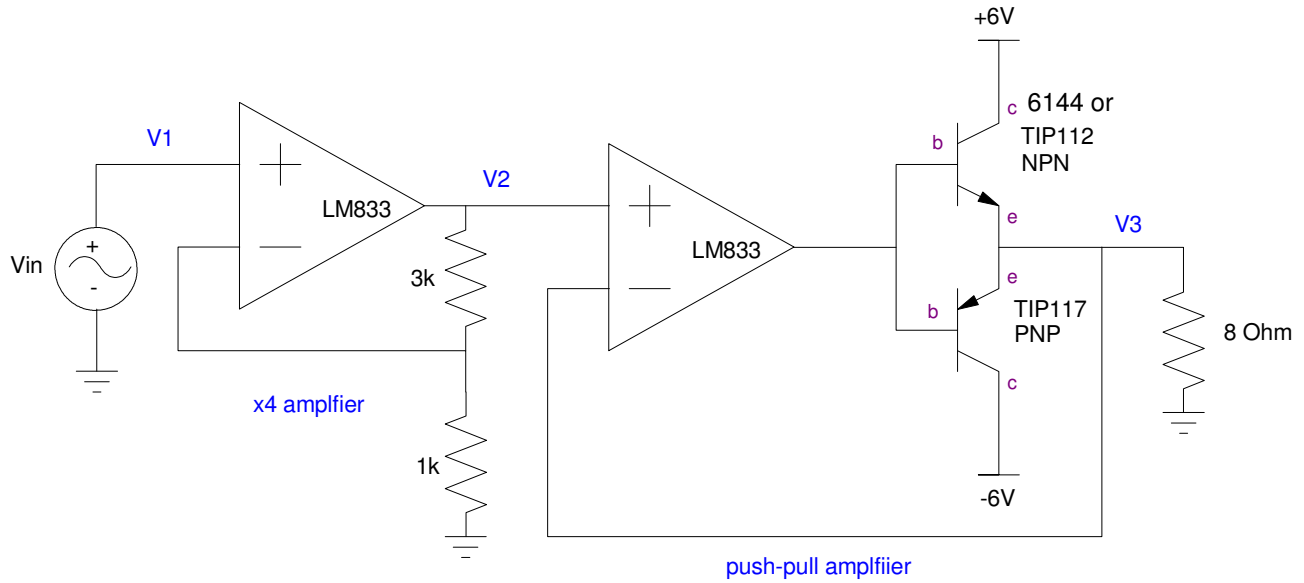
Option #1 (single +5V power supply)

The following circuit

- Creates a 2.5V power supply from a single +5V supply (V0). This 2.5V supply then acts like circuit ground
- Amplifies the output of a cell phone (or computer or 555 timer) (V2), and
- Drives an 8 Ohm speaker (V3)



Option #2 (dual power supplies: +6V & -6V)



For the amplifier you're going to use for the rest of this course...

6) Calculate the voltages and currents when

- $V_{in} = 1.0V$
- $V1 = 1.5V$
- $V1 = 2.0V$

7) Simulate this circuit in CircuitLab with

- $V1 = 1V_{pp}$, 1kHz sine wave

8) Build this circuit in hardware. With a sine wave input, (1kHz) verify that that

- $V2 = 4 \cdot V1$ (relative to circuit ground)
- $V3 = V2$ (relative to circuit ground)

8) Demo

- Replace $V1$ with an audio signal and verify the song plays on the speaker

