ECE 321 - Homework #1

Push-Pull Amplifiers, Op-Amp Amplifiers. Due Monday, November 5th, 2018

ECE 321 Project:

1) Pick a project for ECE 321 (see page 2 for suggestions)

- Give the name of the people in your group
- Specify the requirements for the overall project

For the following sections, assume TIP112 (NPN) and TIP117 (PNP) transistors:

- $\beta = 1000$
- $|V_{be}| = 1.4V$
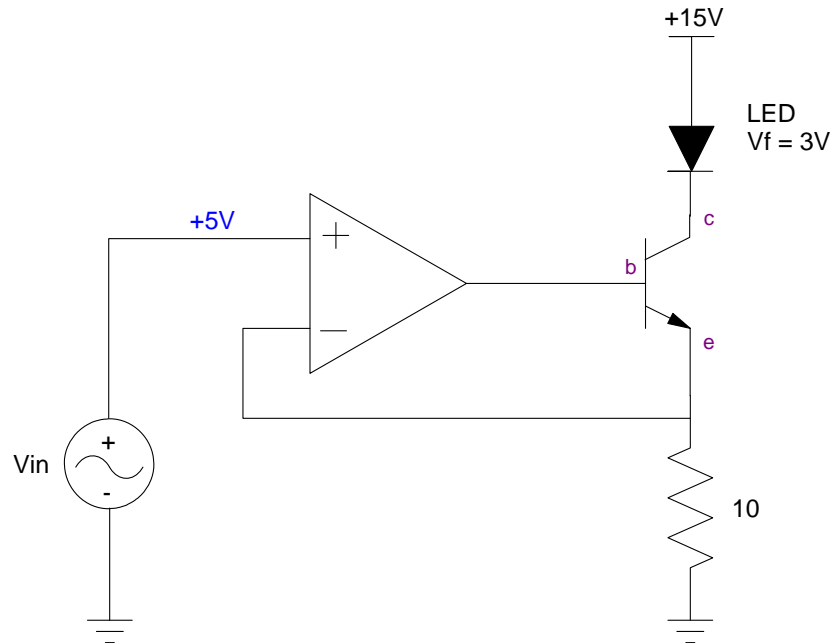- $\min(|V_{ce}|) = 0.9V$
- $\max(|I_c|) = 3A$

Push-Pull Amplifiers

2) Specify the voltages and currents for the following voltage amplifier for

- Vin = +2V
- Vin = -2V
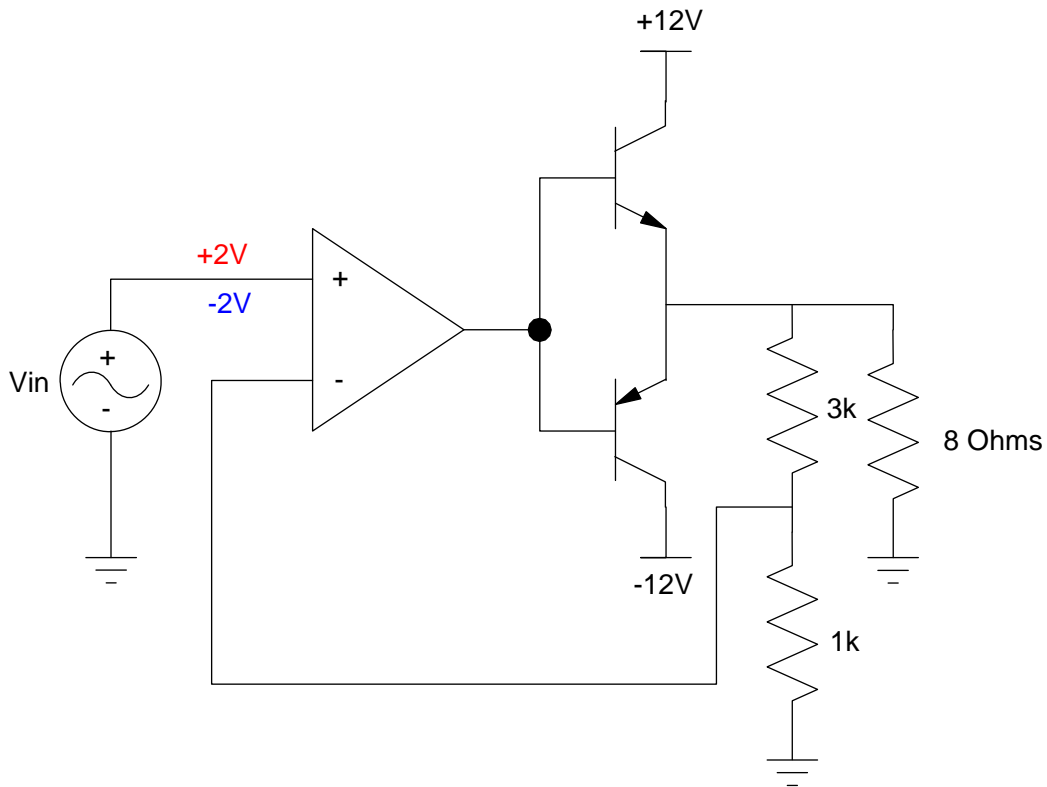
3) Specify the voltages and currents for the following current amplifier for
   - Vin = +5V

Op-Amp Amplifiers

4) Design a circuit which implements the function

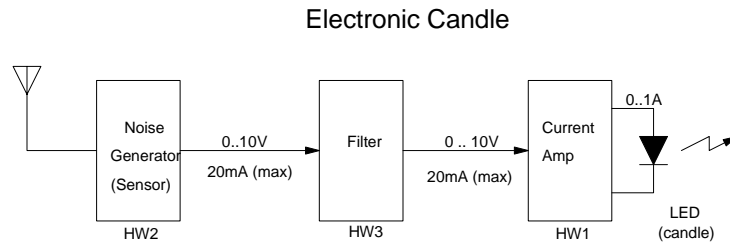   Y = 4X

5) Design a circuit which implements the function

   Y = -4X

6) Design a circuit which implements the function
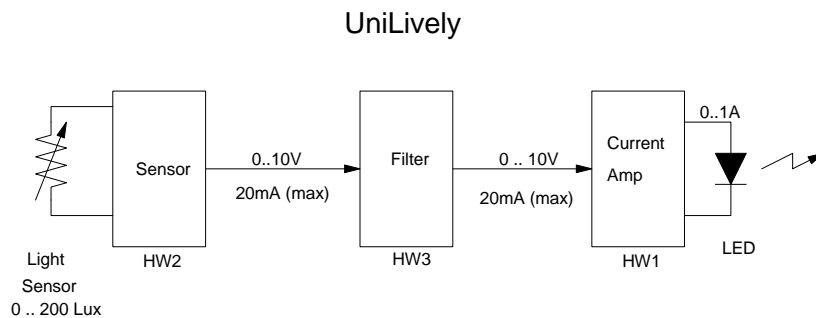
   Y = 4X + 6

Sugggestions for ECE 321 Projects:

a) Electronic Candle: Build a circuit which drives an LED at 0 .. 50 lumens (1A). Have the electronic candle flicker like a real candle.

Electronic Candle

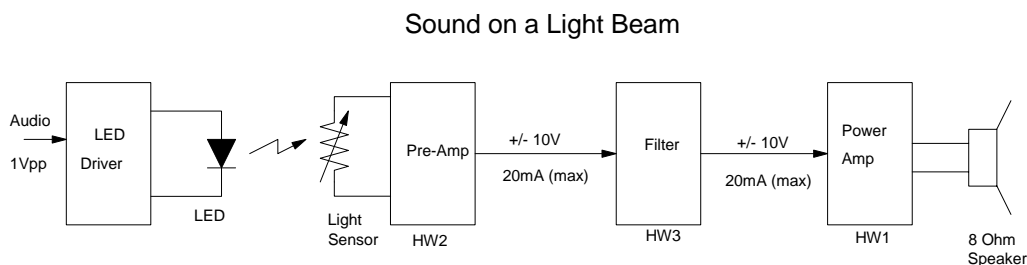| Noise Generator (Sensor) | 0..10V 20mA (max) | Filter | 0 .. 10V 20mA (max) | Current Amp | 0..1A |
| HW2 | | HW3 | | HW1 | LED (candle) |

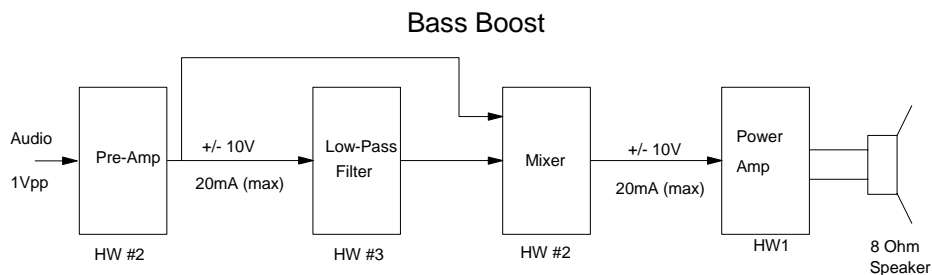**b) UniLively:** Build a single pixel of an OctoLively.
  - If there is no filter, the LED output marches the light from the sensor.
  - With the filter, the LED will bounce up and down (get brighter and dimmer) and then settle out after 4 sec

UniLively

| Light Sensor 0 .. 200 Lux | Sensor HW2 | 0..10V 20mA (max) | Filter HW3 | 0 .. 10V 20mA (max) | Current Amp HW1 | 0..1A LED |

c) Sound on a Light Beam: Build a circuit which transmits sound over a light beam

Sound on a Light Beam

| Audio 1Vpp | LED Driver | LED | Light Sensor | Pre-Amp HW2 | +/- 10V 20mA (max) | Filter HW3 | +/- 10V 20mA (max) | Power Amp HW1 | 8 Ohm Speaker |

d) Bass Boost: Build a circuit to amplify bass (f < 250Hz) and mix it with the original (or different) audio signal

Bass Boost

| Audio 1Vpp | Pre-Amp HW #2 | +/- 10V 20mA (max) | Low-Pass Filter HW #3 | Mixer HW #2 | +/- 10V 20mA (max) | Power Amp HW1 | 8 Ohm Speaker |

e) Other: Design your own system which includes a power amp (push-pull or current), filter, and amplifier