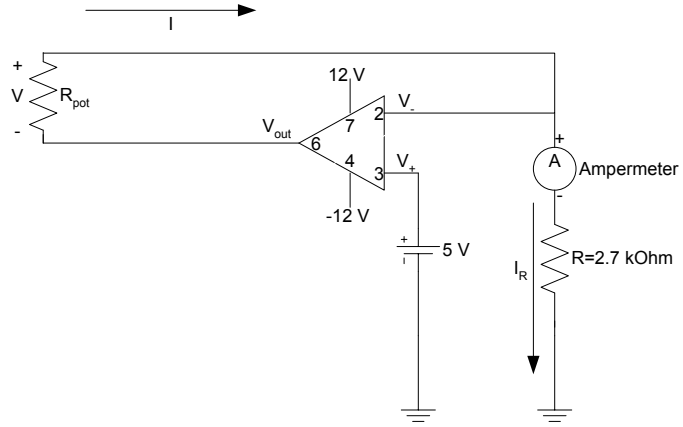
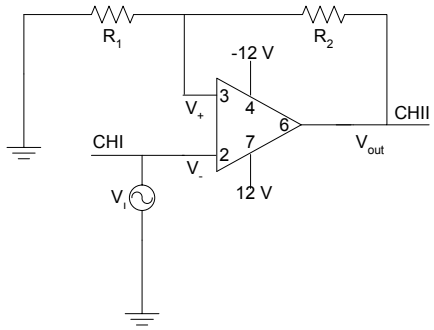
ECE232
Lab 2
Miscellaneous OPMAP circuits

1- The circuit below is used as **a constant current source.** When the resistance of the potentiometer R_{pot} is between 0 Ohm and $R_{pot\text{-}max}$ Ohm, The current I_R over the resistor R becomes constant ($I_{Rconstant}$). The nominal value of the **potentiometer R_{pot} is 10 kOhm**.



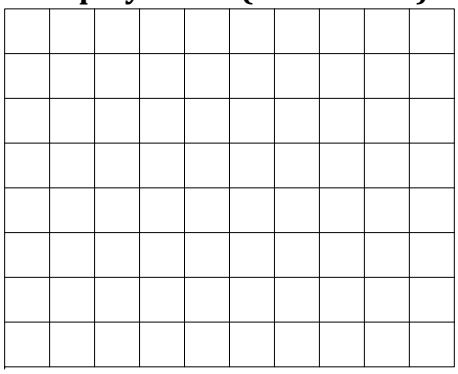
a) What is the **theoretical** value of $R_{pot\text{-}max}$?
b) What is the **theoretical** constant current value ($I_{Rconstant}$) supplied by the circuit when the circuit operates as a constant current source?
c) **Practical work**: Construct the circuit above. Increase the potentiometer resistance until the current over the Ampermeter just began to decrease slightly below the constant current value. Record the constant current value over the Ampermeter as $I_{Rconstant\text{-}practical}$ and then when the circuit operates at this limit point disconnect the potentiometer form the circuit and measure its resistance value and record it at $R_{pot\text{-}max\text{-}practical}$.

2- The circuit below is used to obtain a Hysteresis curve. The circuit components are R_1 = 1000 Ohm an R_2 = 2200 Ohm

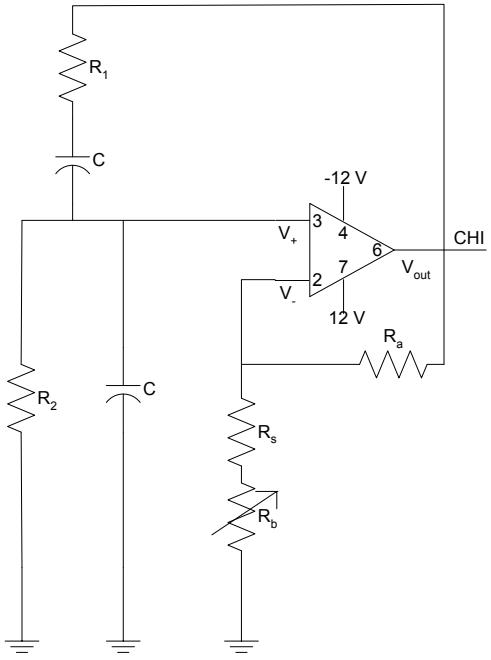


a) **Practical work**: Adjust $V_I(t) = 8\ Sin(2\pi ft)$ Volt where f = 500 Hz. Connect CHI and CHII of the oscilloscope as in the figure. Use **Display menu** of the oscilloscope change **format** to XY. Draw the obtained Hysteresis curve. This curve shows V_I (CHI in x axis) versus V_{out} (CHII in y axis) characteristics of the bistable circuit.

ChI ($V_I(t)$): 5Volt/Div (DC mode)
ChII (Vout(t)): 5 Volt/Div (DC mode)
Second/Div: 1msec/Div
Display menu (format : XY)

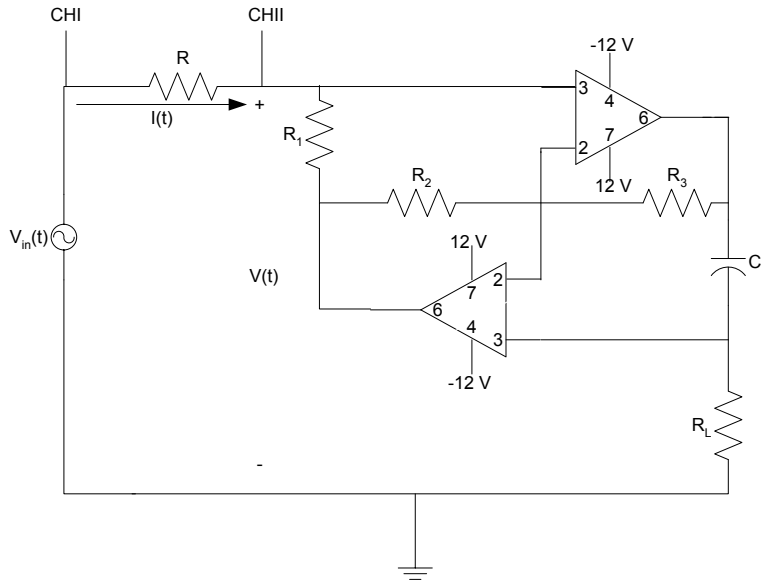


3- The circuit below is a sinusoidal oscillator. The components of the circuit are $R_1 = R_2 = R_a = 10$ kOhm, C = 10 nFarad, **R_b = 5 kOhm potentiometer,** $R_s = 3.9$ kOhm



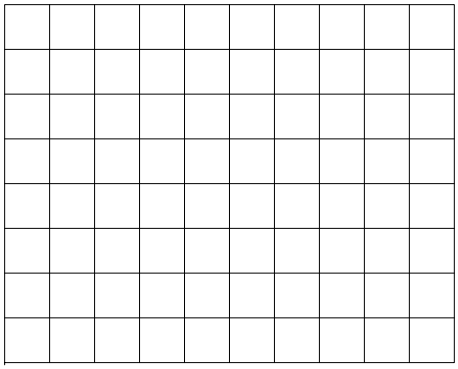
a) What is the **theoretical** value of R_b such $V_{out}(t)$ is a purely sinusoidal signal.
b) What is the **theoretical** value of the frequency of the oscillations $f_{theoretical}$ of $V_{out}(t)$ when R_b is selected as in question **a**.
c) **Practical work:** Set up the circuit in the figure. Connect CHI of the oscilloscope to $V_{out}(t)$ and adjust R_b such that $V_{out}(t)$ is a purely sinusoidal signal. What is the frequency of the oscillations $f_{practical}$ of $V_{out}(t)$. What is the practical value of R_b ($R_{b\text{-}practical}$) such that we observe oscillations at CHI?

4- This circuit below is a gyrator (inductor obtained using different circuit components). The components of the circuit are $R_1 = R_2 = R_3 = R_L = 10$ kOhm, C = 10 μFarad, R= 100 kOhm



a) What is the **theoretical** inductance value L.
b) What is the **theoretical** time-constant of this RL circuit.
c) **Practical work:** Set up the circuit and connect the channels of the oscilloscope as in the figure. Adjust $V_{in}(t)$ ($V_{in}(t)$ is a square wave with 2 Volt peak-to-peak and 1 Volt DC offset value and its frequency is 10 Hz). Draw V_{in} (t) and V(t).

ChI ($V_{in}(t)$): 1Volt/Div (DC mode)
ChII (V(t)): 1 Volt/Div (DC mode)
Second/Div: 20msec/Div or 25msec/Div



d) **Practical work:** Find the time constant of this first order circuit using the plots at. Calculate the inductance value of the circuit L using the time constant.