

<b>SANTA CLARA UNIVERSITY</b>	<b>ELEN 115 Spring 2023</b>	<b>Dr. S. Krishnan</b>
<b>Laboratory #2: Single Time Constant Circuits</b>		

### **Pre-lab:**

Carry out a "paper-and-pencil" analysis of the RC circuit given in Figure 1.  $V_0$  is the initial voltage present across the capacitor terminals just before the switch closes.

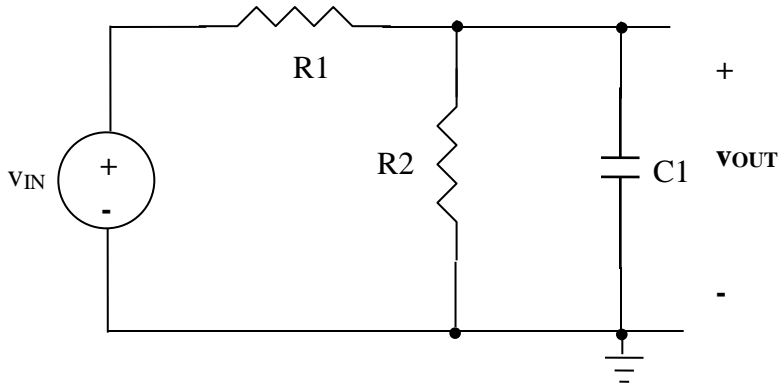


Figure 1: Single time constant circuit

(a) Write the expression for the expected output voltage  $v_{OUT}$  as a function of time in terms of  $R1$ ,  $R2$ ,  $C1$ ,  $V_0$ , input voltage  $v_{IN}$ , and time. Assume that the input switches from 0 to a value  $V_{IN}$  at time  $t=0$ .

(b) Draw the waveform with respect to time for  $v_{OUT}(t)$  for each case below.

Given  $R1 = 20K\Omega$ ,  $R2 = 20K\Omega$  and that  $v_{IN}$  switches instantaneously from 0 to 10V.

There are different cases to consider while doing the calculations for the PRE-LAB:

- (i)  $V_0 = 0$  volts and  $C1 = 0.1\mu F$
- (ii)  $V_0 = 1$  volts and  $C1 = 0.1\mu F$

(c) For an AC source at the input given as  $v_{IN}$

- (i) Classify the circuit as STC high pass or low pass with output  $v_{OUT}$  across  $C1 = 0.1\mu F$ .
- (ii) Find the cutoff or 3dB frequency in Hz for this circuit for  $R1 = 20K\Omega$ ,  $R2 = 20K\Omega$
- (iii) Find the gain  $v_{OUT} / v_{in}$  at
  - $\omega = 0$
  - $\omega = \infty$