ECE 207L - FIRST ORDER RC CIRCUITS - LAB 11
TIME CONSTANTS OF FIRST ORDER RC CIRCUITS

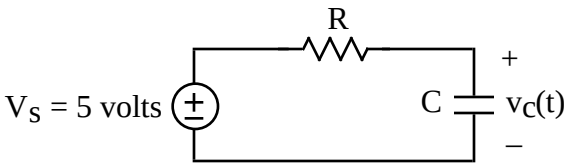
FALL 2003 **A.P. FELZER**

OBJECTIVE

The objective of this lab is to see how the time constant of a first order RC circuit affects its transient and therefore complete response

LAB

1. Given a first order RC circuit with a constant (really a pulse train) input as follows



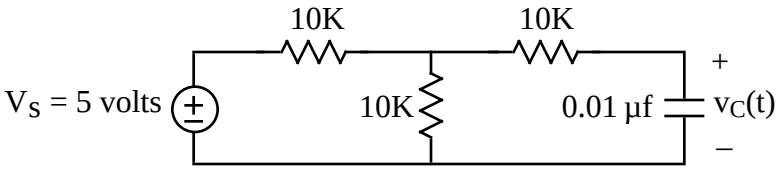
   a. Start with a resistor of value R = 10K and a capacitor of value C = 0.1 µf and a pulse train input that is ON and then OFF long enough for the capacitor to "fully charge and discharge". Then describe what you see happening to $v_C(t)$ as R is decreased. Sketch graphs to illustrate. Explain why $v_C(t)$ changes the way it does.

   b. Is the time constant τ in the circuit in part (a) increasing or decreasing as R is being decreased. How can you tell from what you see happening on the scope

   c. Now start again with a resistor of value R = 10K and a capacitor of value C = 0.1 µf and a pulse train input that is ON and then OFF long enough for the capacitor to "fully charge and discharge". But now describe what you see happening to $v_C(t)$ as C is decreased. Sketch graphs to illustrate. Explain why $v_C(t)$ changes the way it does.

   d. Is the time constant τ in the circuit in part (c) increasing or decreasing as C is being decreased. How can you tell from what you see happening on the scope

2. Given the following first order RC circuit



   a. Make use of what you see on the scope to estimate the steady state value of $v_C(t)$ and the circuit's time constant τ by measuring $v_C(t_O)$ for some time $t = t_O$ and then calculating τ from

$$v_C(t_o) = 2.5 - 2.5e^{-t_o/\tau}$$

   Draw a graph of $v_C(t)$ that shows the location of your t_O

   b. Calculate the circuit's time constant $\tau = R_{TH}C$ and its steady steady value

   c. Compare your results for τ in parts (a) and (b)