EGR 260
Circuit Analysis
File: N260PS3

Due date: _____
(See Due Dates Table)

PSPICE Assignment #3

Reference:

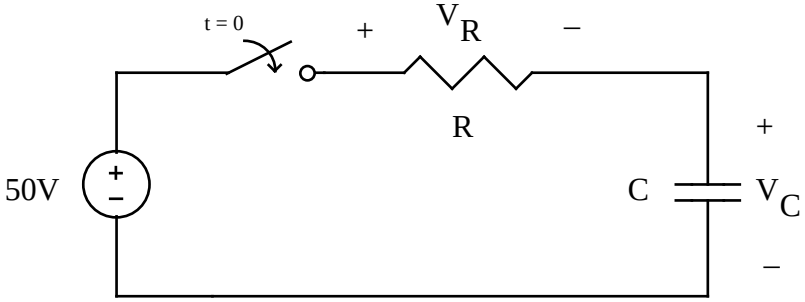
Read Ch 6 (Transient Analysis) in ***Schematic Capture using CADENCE PSPICE*** by Herniter
PSPICE Example: "Transient Analysis of an RC Circuit with a Switch" (File: RCSwitch.opj)
PSPICE Example: "Transient Analysis of an RC Circuit with a Pulsed Source"(File: RCPulse.opj)
PSPICE Example: "Parametric and Transient Analysis of an RC Circuit" (File: P&T_1st.opj)

PSPICE Assignment:

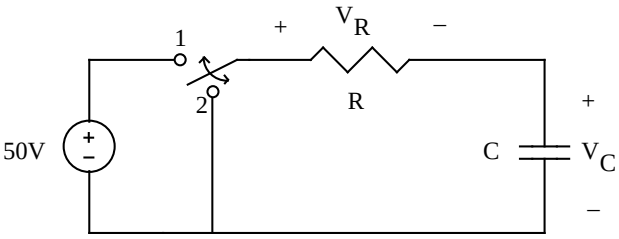
1. **Circuit 1:** Circuit 1 includes a switch that closes at time t = 0 in order to charge the capacitor. Use PSPICE to analyze Circuit 1 using the part Sw_Close in PSPICE to represent the closing switch. Use C = the last 4 digits of your StudentID in nF (e.g., if your StudentID is 23456789, then C = 6789 nF or 6.789 μF.
   - A) **Graph of V_C, V_R, and V_S:** Let R = 100 Ω and generate a single graph using PROBE showing the source voltage, the resistor voltage, and the capacitor voltage from 0 to 5τ = 5RC (you should round this value off to some convenient number). Label each graph. Use a cursor to label points on the capacitor voltage corresponding to τ, 2τ, 3τ, 4τ, and 5τ. In your report compare these values to expected values in a table (do this for part A only).
   - B) **Initial capacitor voltage = 20V:** Let R = 100 Ω and use PROBE graph the capacitor voltage from 0 to 5τ if the capacitor has an initial voltage of 20V (set the IC attribute to 20V). Note that when you insert a capacitor it rotates (Ctrl+R) around its positive terminal. It is important to note which terminal is the positive terminal when using initial conditions. Note: Graph V_C only and it is not necessary to mark any points on the graph.
   - C) **Initial capacitor voltage = 85V:** Repeat step 1B if the initial voltage is 85V.
   - D) **Delayed switch closing:** Let R = 100 Ω and use PROBE graph the capacitor voltage from 0 to 6τ (not 5τ) if the capacitor has an initial voltage of 0V and the switch closes at time t = τ. Note: Graph V_C only and itt is not necessary to mark any points on the graph.
   - E) **Parametric Analysis (V_C vs t for various R values):** Let R vary from 100 Ω to 1600 Ω in 300 Ω increments. Let the switch close at time t = 0 and use an initial capacitor voltage of 0. Use a Parametric Analysis along with a Transient Analysis in order to show a series of curves for the capacitor voltage as R varies. The transient response should allow the slowest response to be graphed to 5τ. Label the value of R next to each curve.

2. **<u>Circuit 2</u>:** Circuit 2A shows a switch opening and closing periodically, allowing the capacitor to periodically charge and then discharge. When analyzing this circuit using PSPICE, we replace the switch and DC voltage source by a pulsed voltage source as shown in Figure 2B. When the pulsed source is HIGH (50V) this circuit acts like Circuit 2A with the switch in position 1. When the pulsed source is LOW (0V) it acts like Circuit 2B with the switch in position 2.) Let R = 100 Ω and use PROBE to graph the source voltage and the capacitor voltage (on the same graph) from 0 to 30τ if the pulsed source still switches every 5τ. This should result in the capacitor being fully charged and fully discharged 3 times.

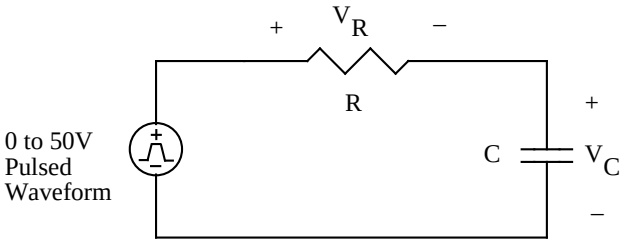
<u>Note</u>: Discuss the results of each analysis in your report. Do they graphs look as expected? Explain why.



Circuit 1



Circuit 2A



Circuit 2B