I Practice Problems: Circuit Analysis

I.I Basics

Problem 1: Show the rules that govern how resistors and capacitors add:

Part 1: Resistors

(i) Series (*will be shown during the session*)

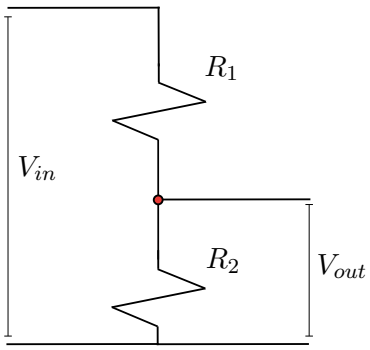
(ii) Parallel

Part 2: Capacitors (use the technique that we discussed)

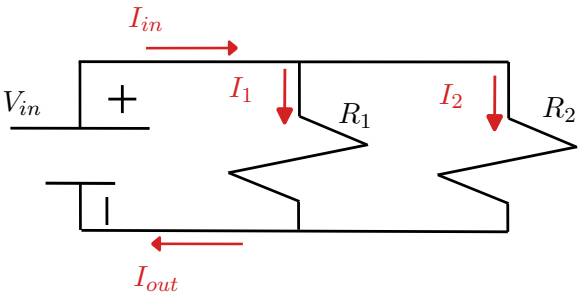
(i) Series

(ii) Parallel

Problem 2: We will be using our circuit analysis techniques to determine formulas for two commonly used topologies in circuit design: *voltage division* and *current division*.



(a) Voltage Divider.



(b) Current Divider.

Figure 1: Common topologies.

(i) Determine V_{out} in Fig. 1a.

(ii) Determine I_1 and I_2 in Fig. 1b.

I.II Node Voltage Method + Mesh Current Method

Problem 3: In Fig. 2 determine the voltages at V_x and V_y using node voltage method and state which of Kirchoff's Laws you are employing.

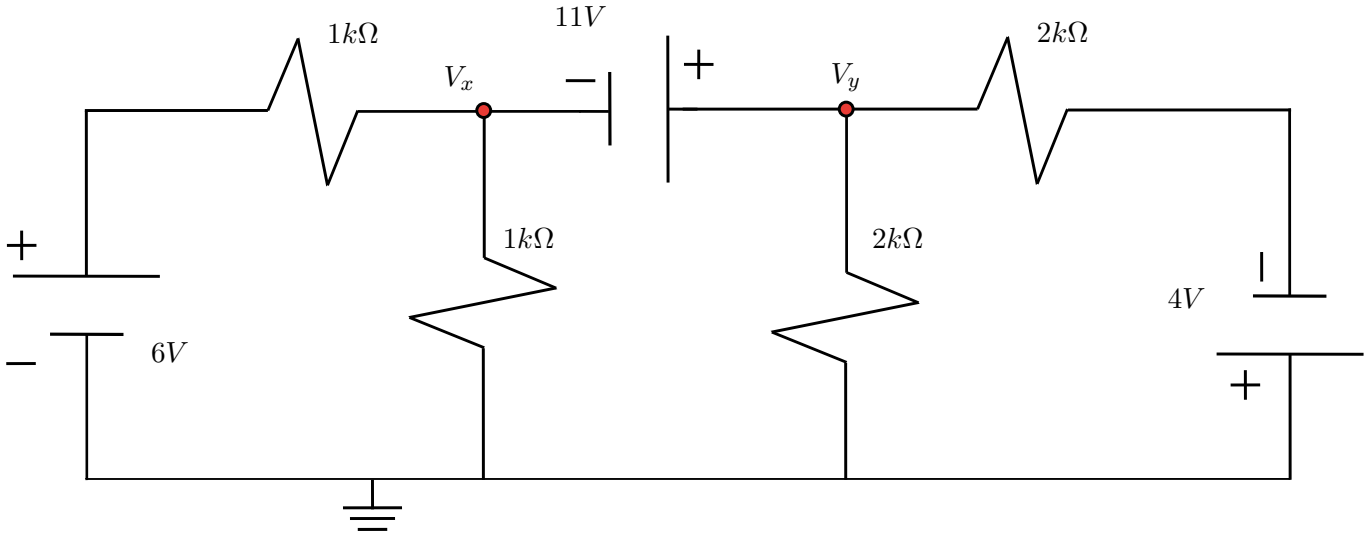


Figure 2: Simple Circuit.

Problem 4: Using mesh current method, determine the voltage at V_x in Fig. 3 and state which of Kirchoffs Laws you are employing.

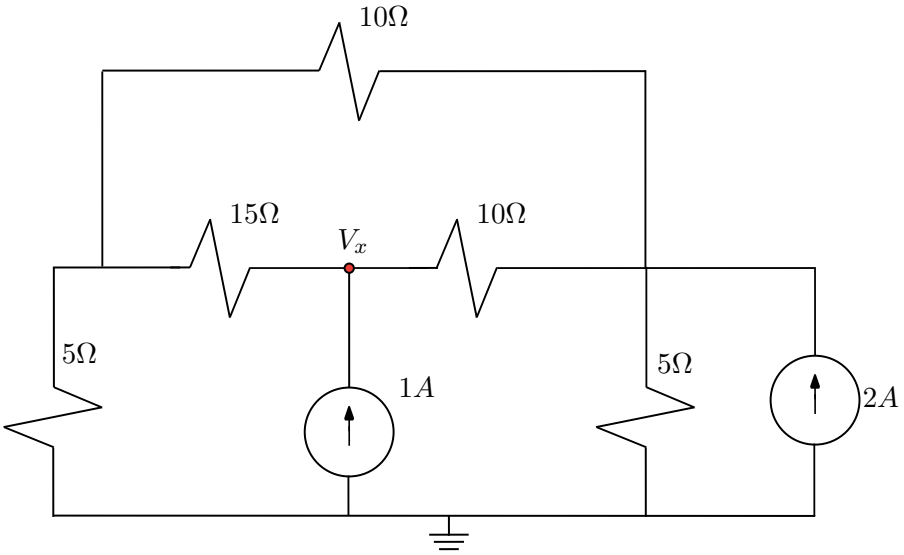


Figure 3: Simple Circuit.

I.III Introduction to RC Circuits

Problem 5: All of the following questions refer to Fig. 4.

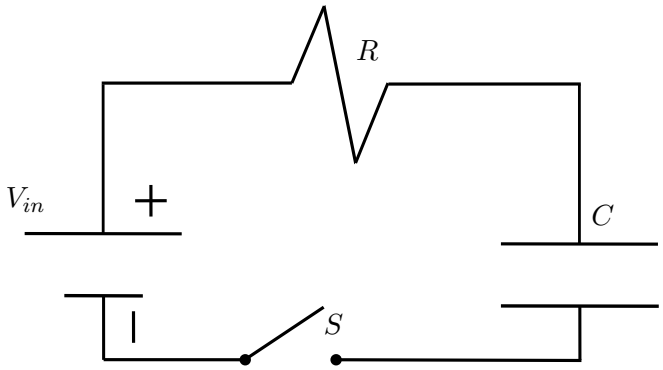


Figure 4: Simple RC Circuit.

(i) If the switch S has been open for a long time, what is the voltage drop across the resistor?

(ii) If we now close switch S and instantly look at the voltage drop across the resistor, what is it?

(iii) If we now wait for a long time after closing the switch, what is the voltage across R and C. (*And what is the charge stored on the capacitor plates?*)

Problem 5 (con't):

(iv) Using differential equations, find an expression that describes the charge and current on the plates of the capacitor as a function of time.

What are your major takeaways/things that you want to remember?