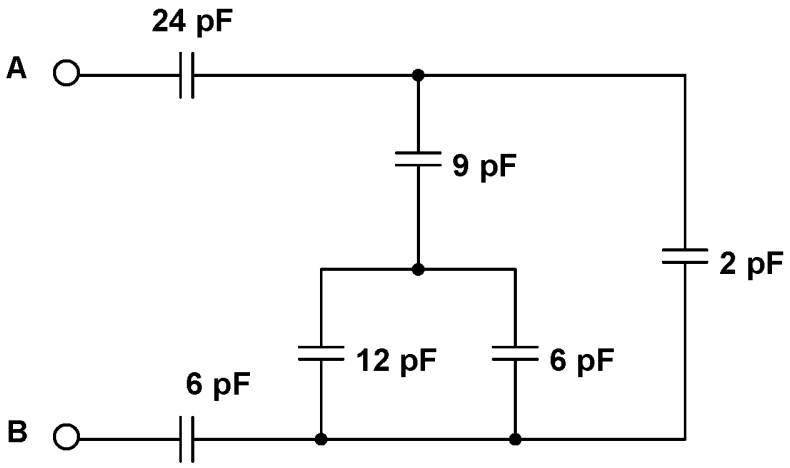
ECE 2350 CIRCUIT ANALYSIS I

Homework 7 Revised
5 March 2020

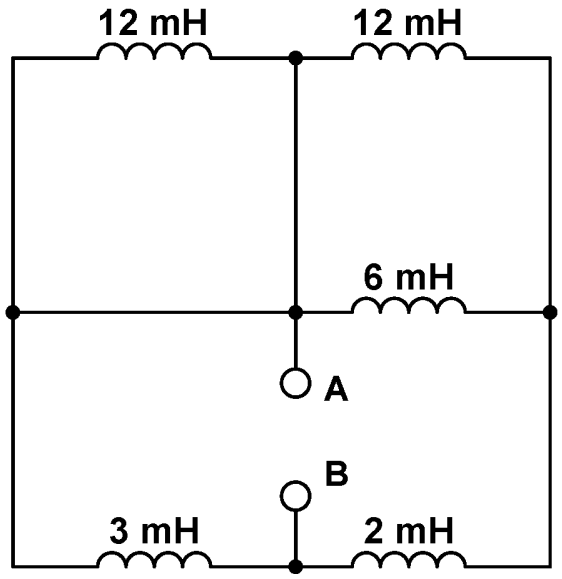
Professor Dunham
Due: 12 March 2020

Review Lecture Notes.

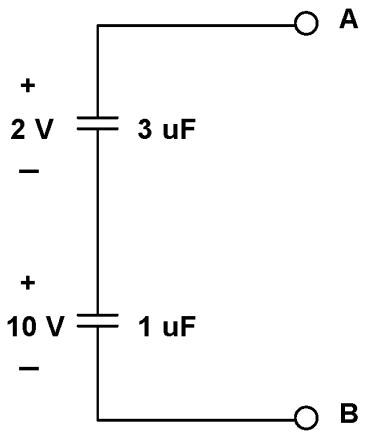
1. Find C_{eq} in the circuit below.



2. Find L_{eq} in the circuit below.



3. Two capacitors are connected together as shown in the figure below after having been separately charged .



   (a) Find the total stored energy as well as the fraction of this energy that can be recovered by bringing the terminal voltage v_{AB} back to zero. *Hint:* An electric circuit conserves charge. When two charged capacitors are connected together, their charges either add together or subtract, depending on their voltage polarity. When shorted together, the charges redistribute so that both capacitors have the same voltage across them and thus sum to 0 V. Thus one should always becareful when handing circuits with capacitors as they may have energy stored in them when powered off.

   (b) Repeat if the polarity of the voltage on the $3\,\mu F$ capicitance is reversed.

4. You are given a $1,000$ pF capacitor. The current flowing through this capacitor is described by

$$\begin{cases} 2\,\mu\text{A} & 0 \le t \le 2\,\text{msec} \\ -4\,\mu\text{A} & 4\,\text{msec} \le t \le 6\,\text{msec} \\ 1\,\mu\text{A} & 8\,\text{msec} \le t \le 12\,\text{msec} \\ 0 & \text{else} \end{cases}.$$

   (a) Accurately sketch the current flowing in the capacitor for 14 msec starting at time $t = 0$.

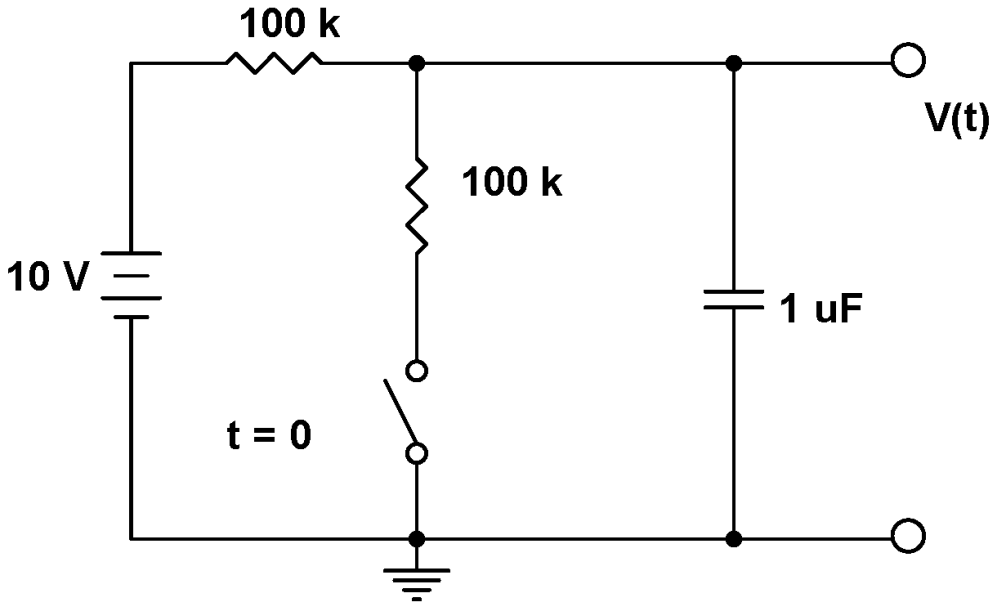
   (b) Find the voltage across the capacitor for the same period of time, assuming that this voltage is zero at time $t = 0$. An accurate sketch will suffice.

   (c) Find the instanteous power in the capacitor for the same period of time. An accurate sketch will suffice.

   (d) What is the maximum amount of energy stored in the capacitor and at what points in time does this occur?

   (e) At what points in time is no energy stored in the capacitor?

5. Use nodal analysis and differential equation methods to find $v(t)$ in the circuit below and plot it for time $t \geq 0$. Note that the switch closes at time $t = 0$ and assume that the circuit is in the steady-state for time $t < 0$.



6. Use nodal analysis and differential equation methods to find $v(t)$ in the circuit below and plot it for time $t \geq 0$. Note that the switch closes at time $t = 0$ and assume that the circuit is in the steady-state for time $t < 0$.