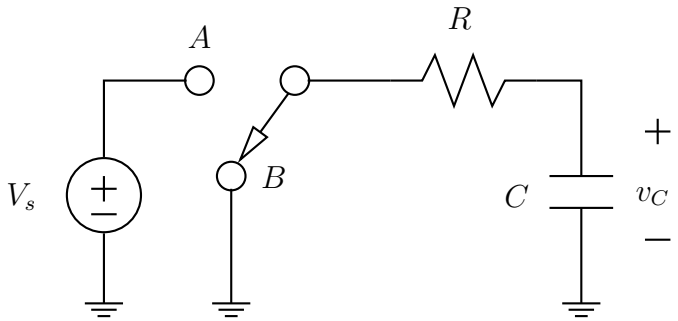
EEE 33 first semester AY2011-2012 : Homework 3

1. The switch in the circuit below has been at position B for a long time.
At time $t = 0, 2T, 4T, \ldots$, the switch moves to position A where T is some time interval.
At time $t =$ T, $3T, 5T, \ldots$, the switch moves to position B.



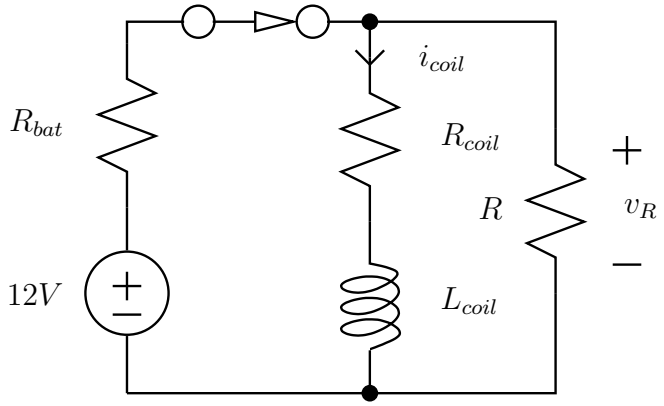
a. Determine and plot $v_C(t)$ for $0 < t \leq T$. What are $v_C(T^-)$ and $v_C(T^+)$?
b. Determine and plot $v_C(t)$ for $T < t \leq 2T$. What are $v_C(2T^-)$ and $v_C(2T^+)$?
c. Determine $v_C(3T)$, $v_C(4T)$, and $v_C(5T)$.
d. Determine a general form for $v_C(kT)$ where k is an odd integer.

2. Given that for $|x| < 1$,

$$\frac{1}{1 - x} = 1 + x + x^2 + x^3 + \ldots$$

a. For large k in part 1(d), use the above identity to write a simple expression for $v_C(kT)$.
b. If $RC = 100T$, show that $v_C(kT) \approx V_s/2$ for large k.

3. The switch in the circuit below has been closed for a long time.
At time $t = 0$, the switch is opened. Given that $R_{bat} = 4\ \Omega$, $R_{coil} = 2\ \Omega$, and $R = 10\ k\Omega$,



a. What are $i_{coil}(0^-)$, $i_{coil}(0^+)$, $v_R(0^-)$ and $v_R(0^+)$?
b. Determine $i_{coil}(t)$ and $v_R(t)$ for $t \geq 0$.
c. Plot $i_{coil}(t)$ and $v_R(t)$ for $t \geq 0$.

4. For problem 3, determine the value of L_{coil} such that $v_R(1\ ms) = 0.5v_R(0^+)$. Show your solution. Plot $v_R(t)$.