Homework 3

Due data: Mar.28th

Turn in your homework in class

Rules:

- Please work on your own. Discussion is permissible, but extremely similar submissions will be judged as plagiarism!
- Please show all intermediate steps: a correct solution without an explanation will get zero credit.
- Please submit on time. No late submission will be accepted.
- Please prepare your submission in English only. No Chinese submission will be accepted.

1

[10 points] Known capacitance C=2pF, and $u_c(0_-) = -1mV$, its current waveform is shown in Figure 1. Find the capacitor voltage as a function of time, and draw its waveform.

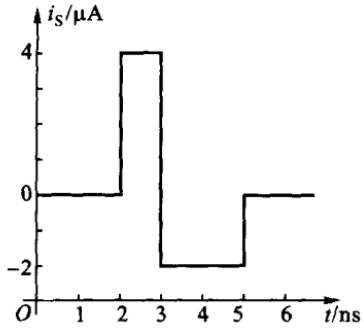

Figure 1

2

[10 points] With a and b as circuit terminals, please make the circuit diagram shown in Figure 2 equivalent to the series connection of a capacitor and an inductor. Find the values of the equivalent inductance L and the equivalent capacitance C.

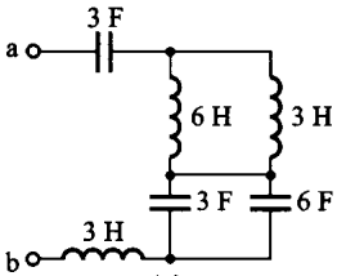

Figure 2

3

[10 points]The circuit in the Figure 3 has reached steady state before t=0. The switch S is closed when t=0. Known that: $U_{S1} = 6V, U_{S2} = 24V, R_1 = 3\Omega, R_2 = 6\Omega, C = 0.5\mu F$, find $u_c(t)$ after S is closed($t \geq 0$).

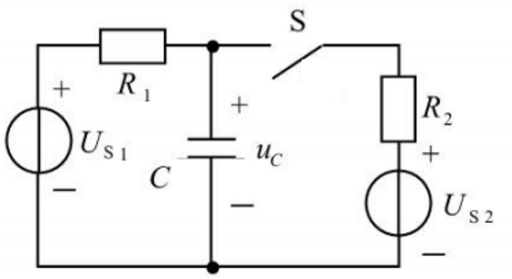

Figure 3

4

[12 points]Known that $L_1 = 6H, i_1(0) = 2A, L_2 = 1.5H, i_2(0) = -2A, u = 6e^{-2t}V$.

(a). Find the expression of equivalent inductance L and the equivalent initial current $i(0)$.

(b). Considering the equivalent inductor, find $i(t)$.

(c). Considering two seperate inductors, find $i_1(t)$ and $i_2(t)$. Check whether the KCL holds, i.e., whether $i(t)$ equals to $i_1(t) + i_2(t)$.

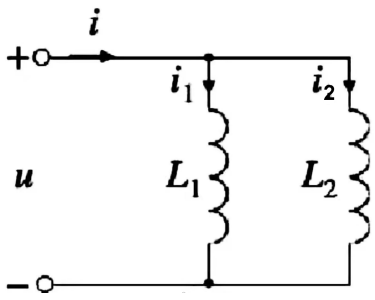

Figure 4

5

[12 points]The circuit is shown in the Figure 5. Write the first-order differential equation with the inductor current i_L as the variable(you don't have to solve it). The values of u_s, i_s, R_1, R_2, and L are known.

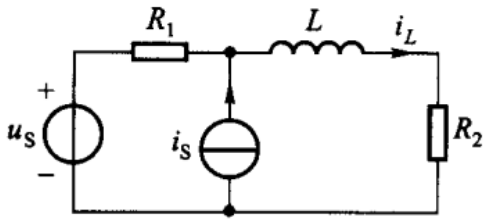

Figure 5

6

[14 points] The circuit is shown in the Figure 6. Write the first-order differential equation with the inductor current i_L as the variable(you don't have to solve it). The values of $u_s, L, R_1, \mu, R_2, R_3$ are known.

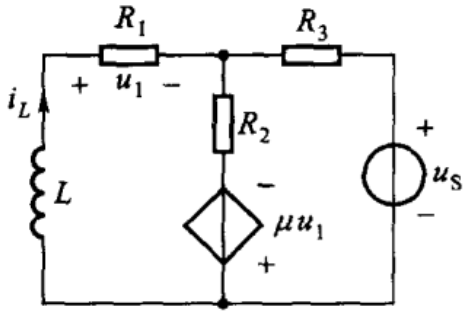

Figure 6

7

[16 points] The circuit is shown in the Figure 7. The switch is at position 1 and the circuit has reached steady state before $t = 0$. When t=0, the switch changes from position 1 to position 2. Find the inductor voltage $u_L(t)$ when $t \geq 0$.

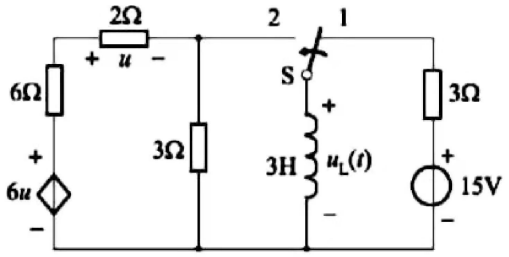

Figure 7

8

[16 points] At t=0, the double-pole switch in the circuit shown in figure is closed. The initial voltages on the capacitors are 12V and 4V, as shown in Figure 8. Find the numerical expressions for $v_0(t), v_2(t)$ and $v_f(t)$. Assume the operational amplifier is ideal (Hint the operational amplifier can work in either linear region or saturation region, based on the rest of the circuit)

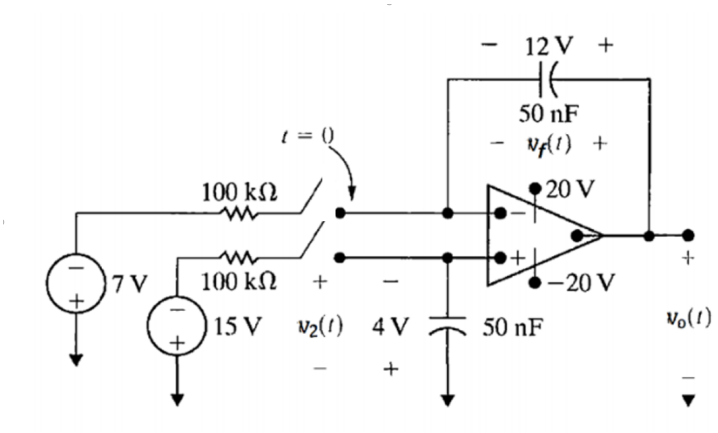

Figure 8