EE111 Spring 2022

Electric Circuits Midterm

May 11 2022, 10:00 AM – May 12 10:00 AM

Rules:

- This is an open-book exam.
- Work on your own.
- Do NOT put your answer directly on this exam paper. Put your answer on blank papers ("answer sheets"). For each problem, draw the circuit on your answer sheets and write down your answers.
- Please show all intermediate steps: a correct solution without an explanation will get zero credit.
- Please upload the answers to 'Blackboard' on time. No late submission will be accepted.
- Please prepare your submission in English only. No Chinese submission will be accepted.

1. **(10 points)** The circuit is shown in Figure 1. Known that $k = 2$. Using nodal analysis to find i_0.

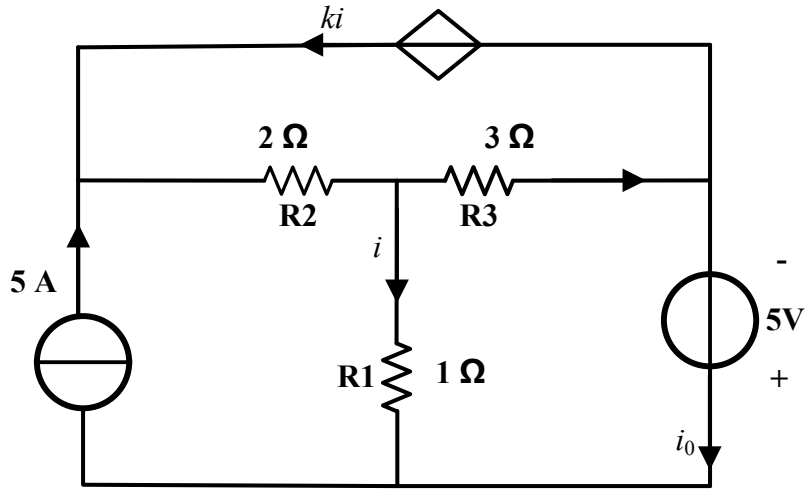

Figure 1

2. **(10 points)** The circuit is shown in Figure 2.
   (1) Find the value of *R* when *R* consumes the maximum power;
   (2) Calculate the maximum power consumed by R.

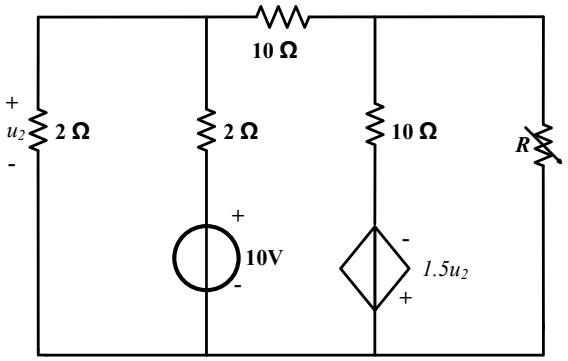

Figure 2

3. **(12 points)** The circuit is shown in the Figure 3. The operational amplifiers are ideal and work in their linear range. All the resistance values $R_1 \sim R_5$ are known. Find the ratio of u_o/u_i.

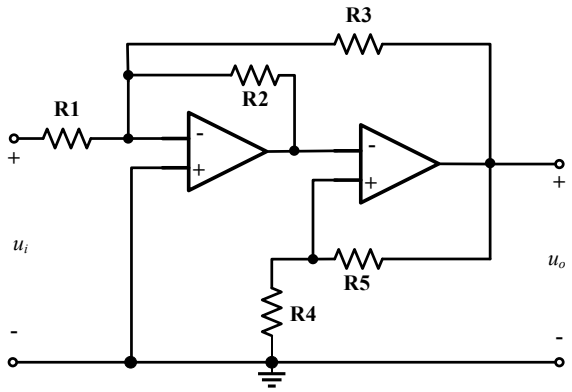

Figure 3

4. **(12 points)** The circuit is shown in Figure 4.
   (1) Derive the Thevenin equivalent circuit of the circuit in the dashed box seen from the ports a and b**;**
   (2) Find i.

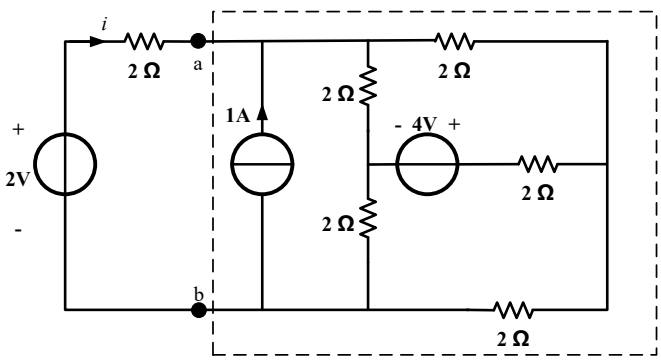

Figure 4

5. **(14 points)** The circuit is shown in Figure 5. The switch has been opened for a long enough time before t=0. When t=0, the switch is closed. Find the value of $i_1(t)$ and $i_2(t)$, when $t > 0$.

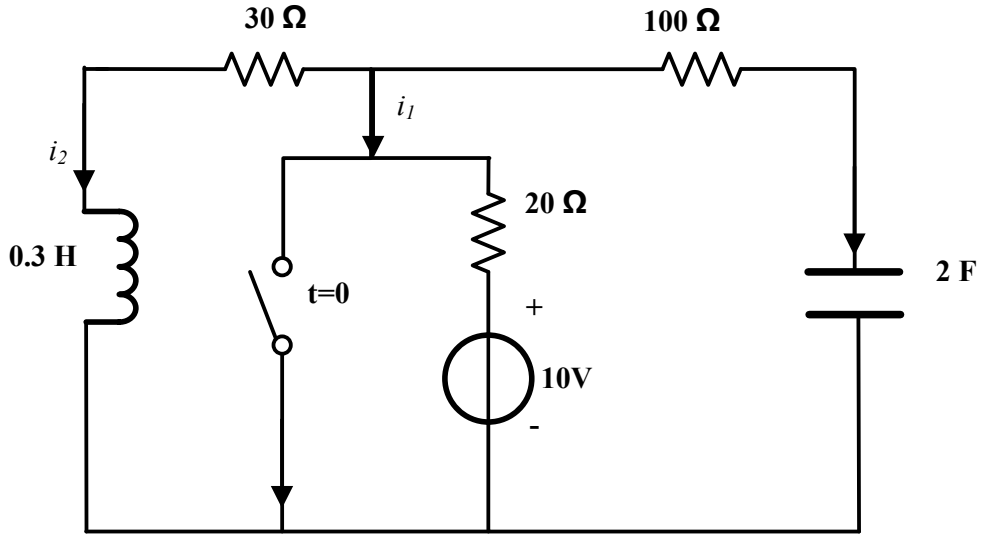

Figure 5

6. **(14 points)** The switch in the circuit shown in Figure 6 has been open for a long enough time before t = 0. The switch is closed at t = 0. Find the expression of $u_C(t)$ and $i(t)$ for t > 0.

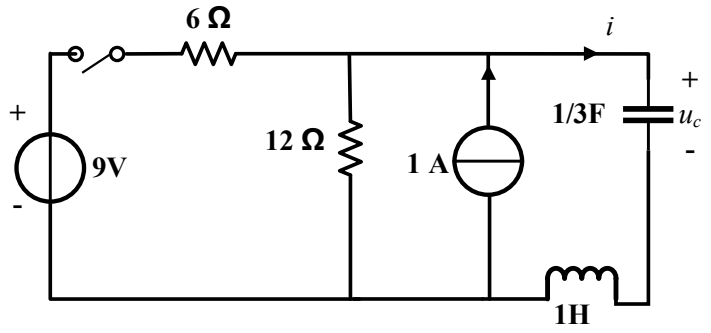

Figure 6

7. **(14 points)** In the circuit shown in Figure 7, known $i(0\_) = 0$ A, $v_C(0\_) = 2$ V. The switch is closed at $t = 0$ s. Find $v_C(t)$ for $t \geq 0$ in the time domain.

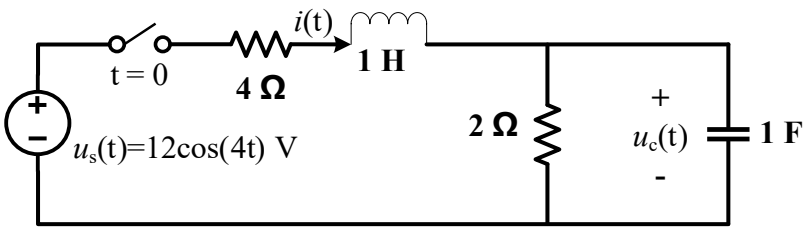

Figure 7

8. **(14 points)** The circuit is shown in Figure 8. The operational amplifiers are ideal and work in their linear range. If $v_1(0^+)$ = 2 V, $v_2(0^+)$ = 0 V, R = 100 kΩ and C = 1 μF, find $v_o(t)$ for t > 0.

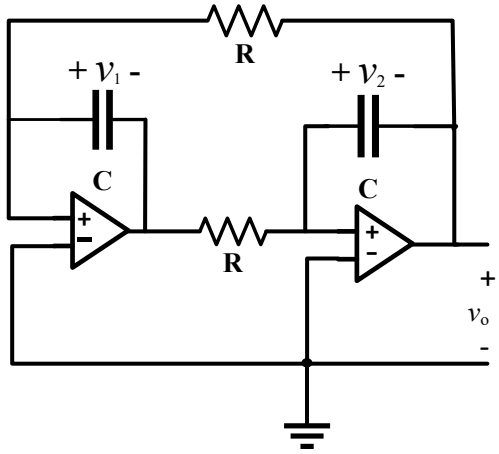

Figure 8