類組：電機類　科目：電路學(3009)　※請在答案卷內作答

1. **Find** the current i of the following network as shown in Fig. 1 by superposition. (10%)

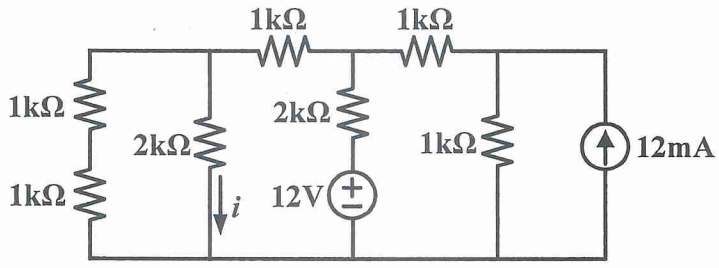

Fig. 1

2. (a) Find the Thévenin equivalent for the network (as shown in Fig. 2a) at the terminals CB. (8%)

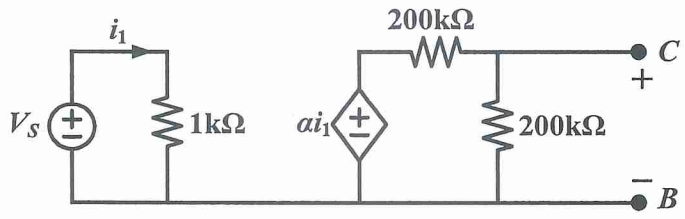

Fig. 2a

(b) Now suppose you connect a load resistor across the output of your equivalent circuit as shown in Fig. 2b. Find the value of R_L which will provide the maximum power transfer to the load. (2%)

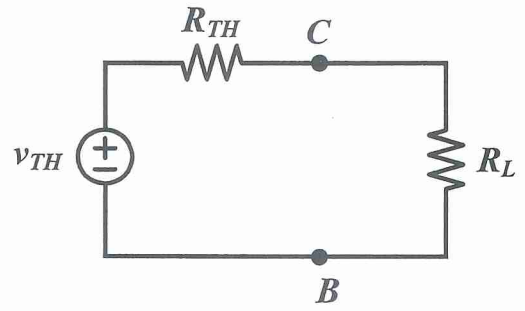

Fig. 2b

3. Consider the circuit illustrated in Fig. 3 below. Assume that the operational amplifier is ideal with input resistance r_i very large and output resistance r_o negligibly small, such that $i_+ = i_- \cong 0$, and $v_O = A(v_+ - v_-)$ with A very large. Assume it is operating in its linear range. **Find** the voltage gain v_O/v_i as a function the resistances of the resistors in the circuit. (10%)

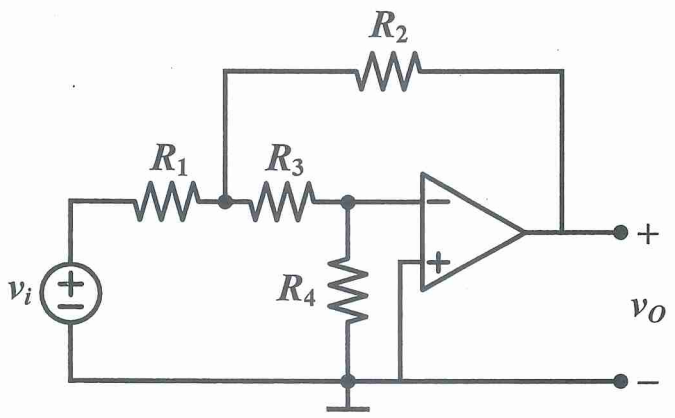

Fig. 3

參考用

注意：背面有試題

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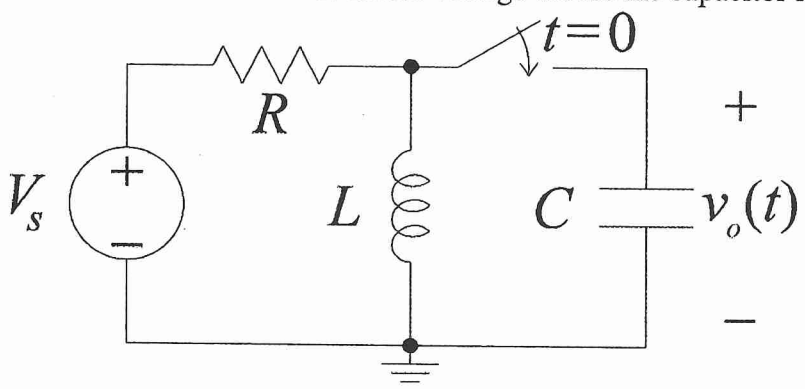
4. Consider the RLC circuit given below. The constant voltage source V_S had been activated long before the switch was closed at t=0. The initial voltage across the capacitor is $v_o(0^-) = V_0$.

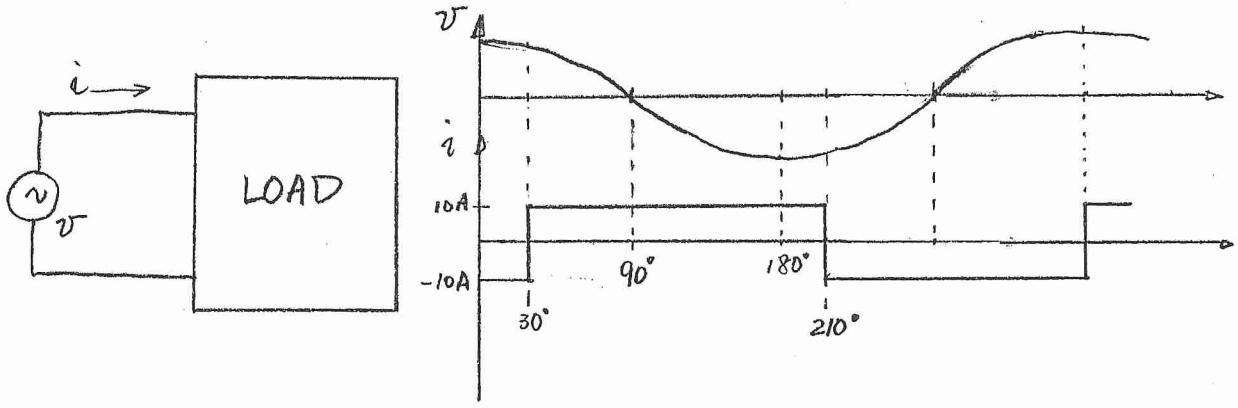


(a) (5%) Derive the two initial conditions $v_o(0^+)$, $v_o'(0^+)$, and the steady-state value $v_o(\infty)$. Justify your answer.

(b) (5%) Derive a second-order differential equation for the capacitor voltage $v_o(t)$. Justify your answer.

(c) (10%) Roughly sketch $v_o(t)$ for 0<t<(0.1 s) if $R = 250\,\Omega$, $C = 25\,\mu\text{F}$, $L = 6.25\,\text{H}$, $V_S = 7.5\,\text{V}$, $V_0 = 1\,\text{V}$. Justify your answer.

5. (5%) The voltage $v = 100\cos(10t)$ V, and the current i is a square wave of 10A as illustrated. Find the apparent power, average power, and the reactive power consumed by the load.



參考用

6. (15%)You are asked to design a system to deliver AC power to three constant power loads, each load consumes 1kW. Two types of AC generators are available

a. A single-phase generator of 200Vrms (line-to-line) output.

b. A three-phase generator of 200Vrms (line-to-line) output.

A fixed amount of copper is provided so you can make the power lines to connect these loads to the generator. Please choose a generator type so that the transmission losses can be minimized. Draw the circuit diagram of your design and provide the necessary analysis to show that your design achieves minimum loss.

注意：背面有試題

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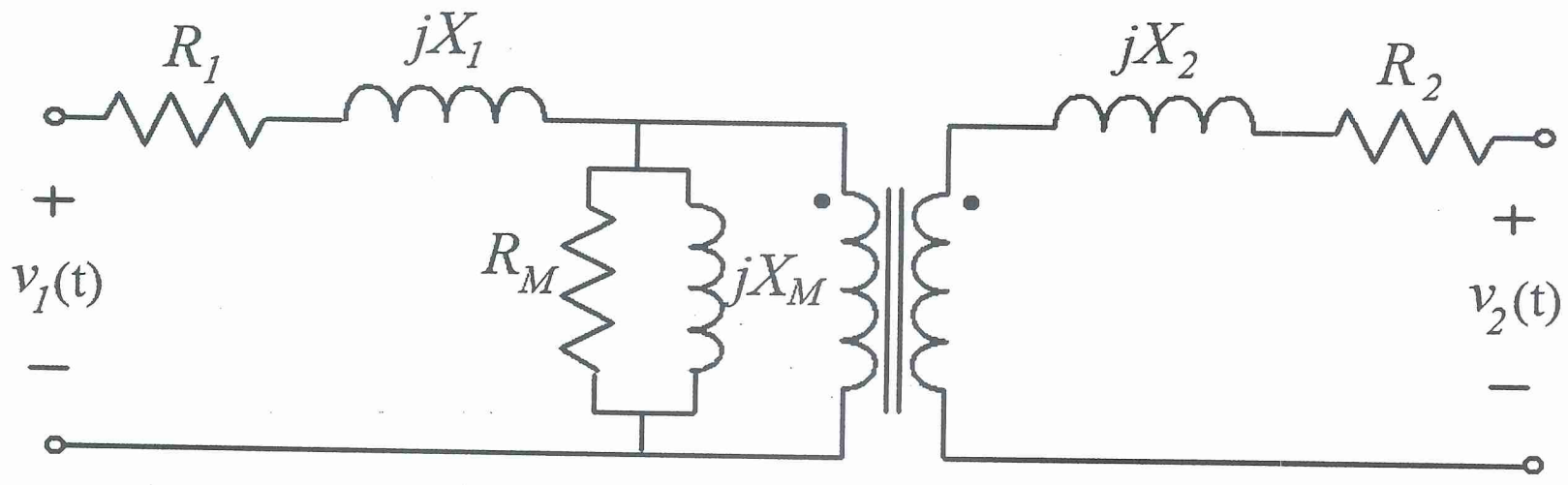
7. (a) (5%)Draw a boost converter and describe its operational principle.
(b) (5%)Sketch voltage and current waveforms of the switch in the boost converter to explain hard switching manner.

8. (10%) An equivalent circuit of a transformer is shown as follows. Explain the physical meaning of each component in the circuit.



9. (a) (5%) Draw a half-bridge full-wave rectifier and a full-bridge one.
(b) (5%) List an example to explain the application of a full-bridge full-wave rectifier.