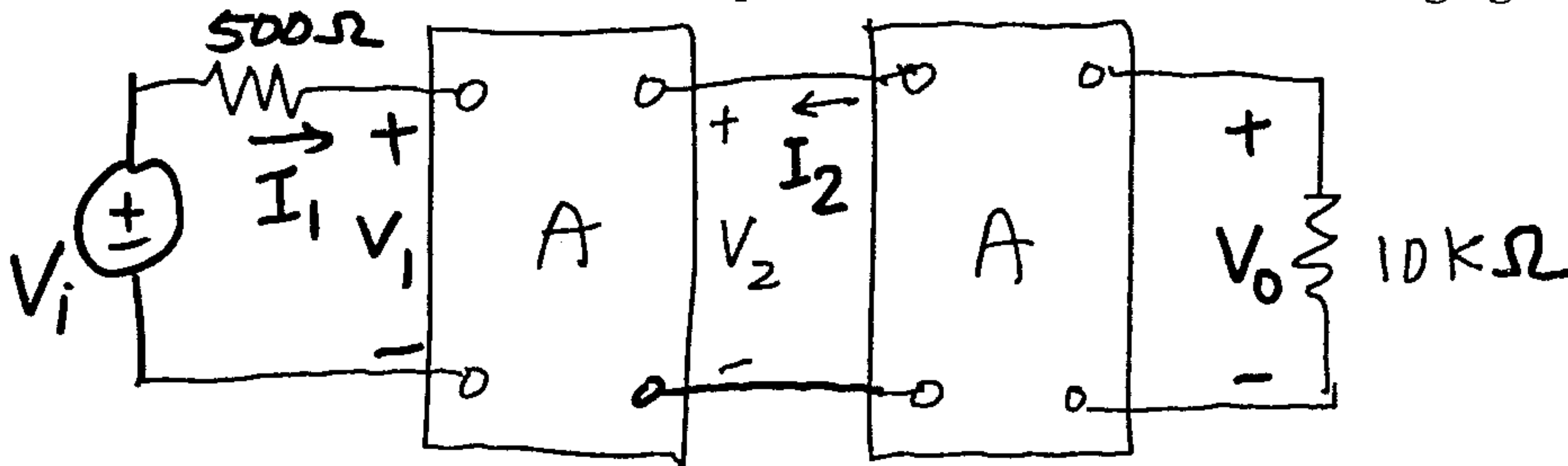


科目：電路學(3009)

校系所組：清華大學電機工程學系(甲組)

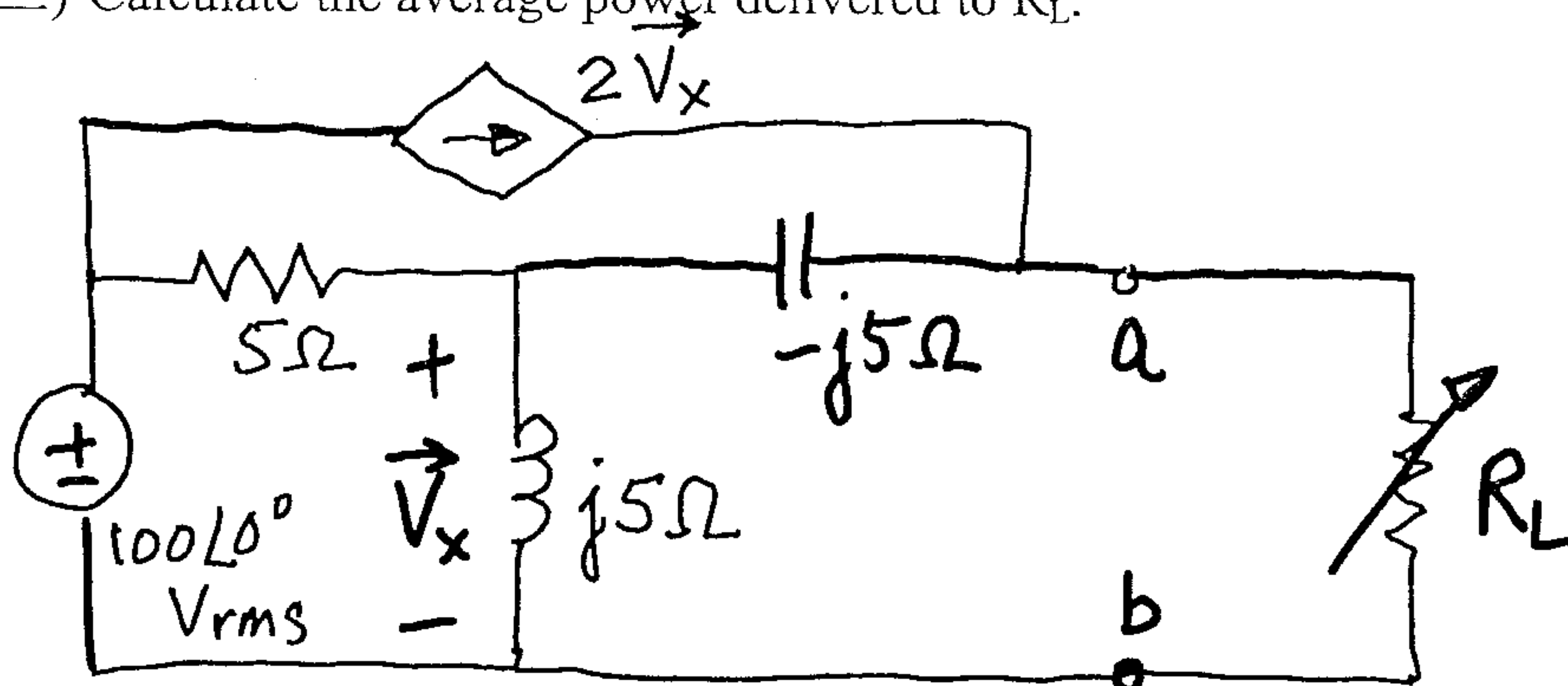
- 一、 (15%) Two identical amplifiers are connected in cascade as shown in the following circuit. Each amplifier is described in terms of its h parameters. Please find the voltage gain  $V_o/V_i$ .



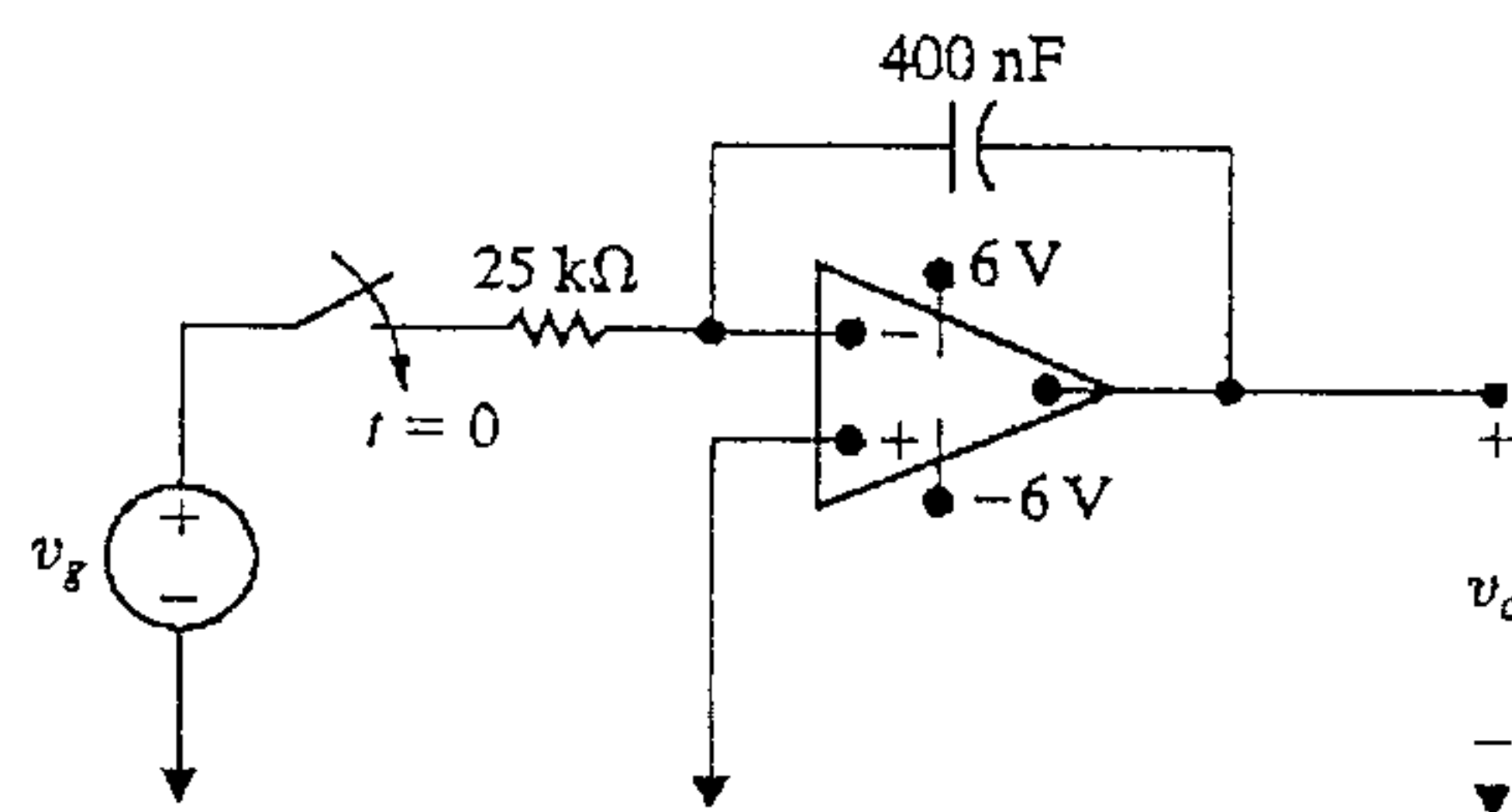
$$\begin{bmatrix} V_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 1000\Omega & 0.0015 \\ 100 & 100\mu S \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix}$$

- 二、 (15%) The variable resistor  $R_L$  in the following circuit is adjusted until maximum average power is delivered to  $R_L$ .

- (一) What is the Thevenin's equivalent circuit looking into terminals a-b?
- (二) Calculate the average power delivered to  $R_L$ .



- 三、 (15%) Suppose that the 400 nF capacitor in the following circuit does not have any initially stored energy and the OpAmp is ideal. Please derive the expression of  $v_o$  for  $t > 0$  if  $v_g$  is 1 V.

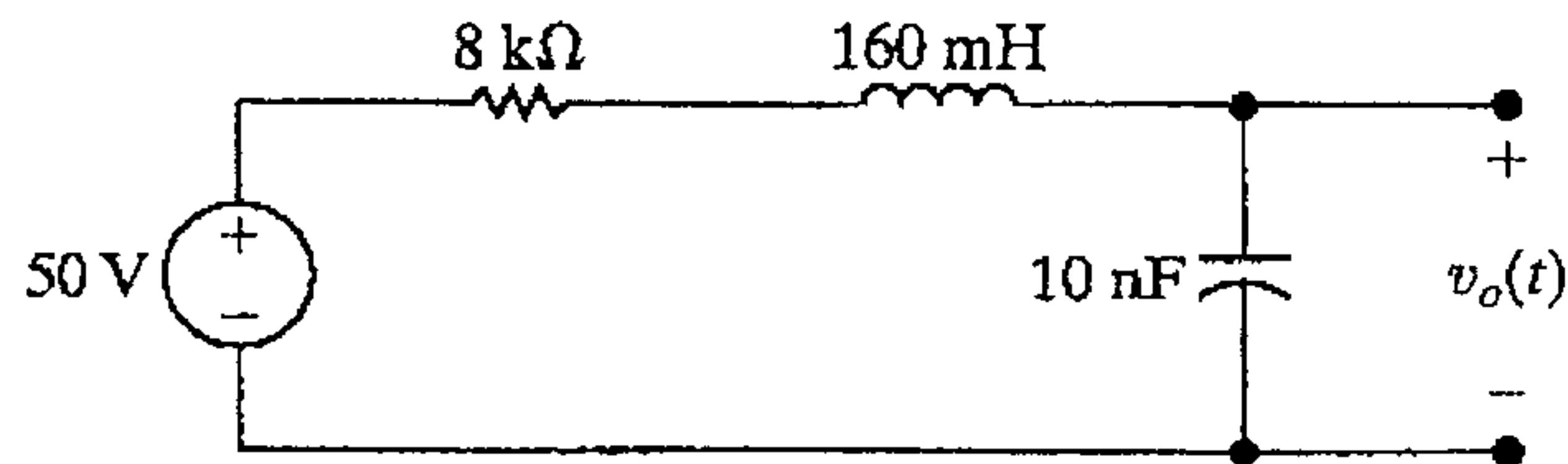


參考用

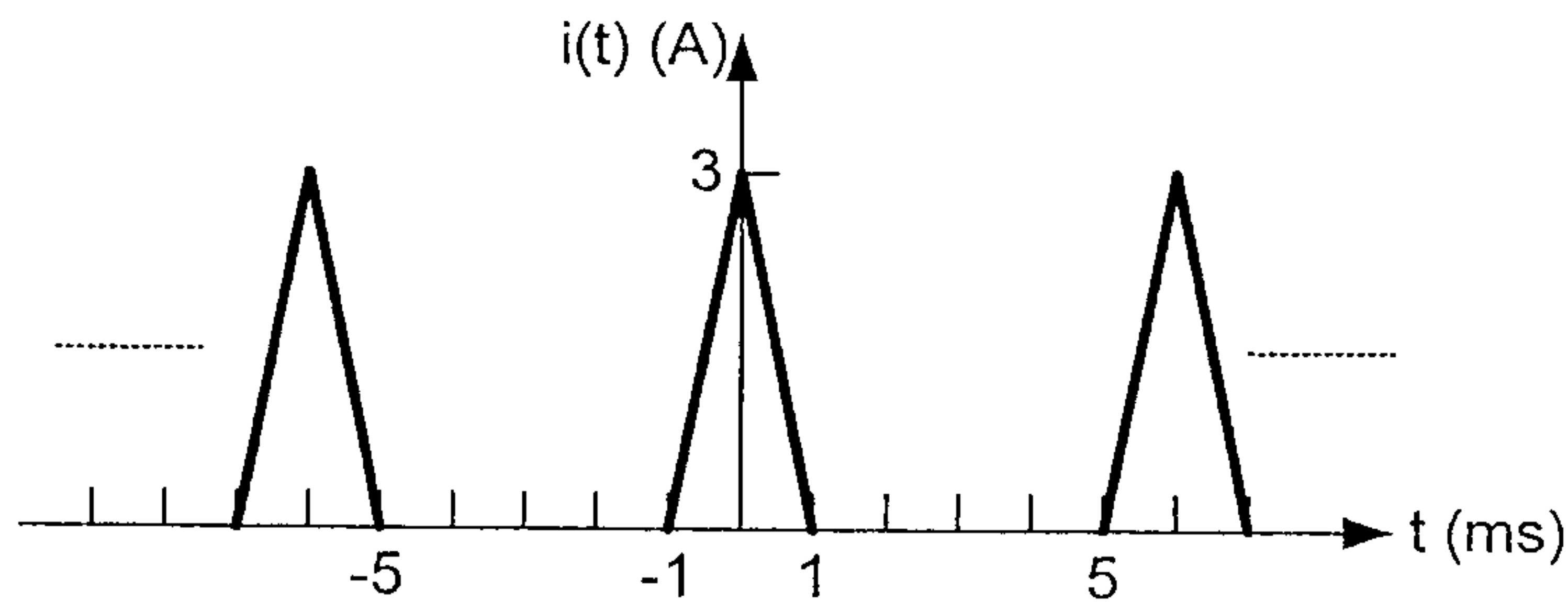
科目：電路學(3009)

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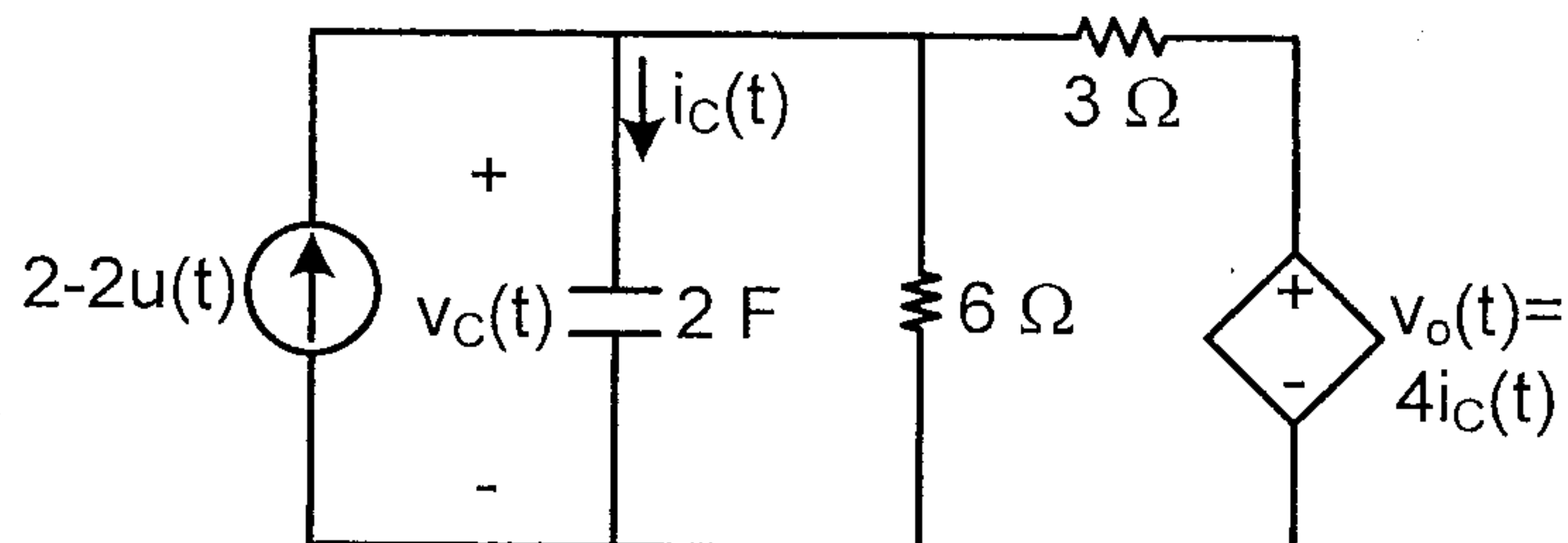
四、 The following circuit has been in operation for a long time. At  $t=0$ , the source voltage suddenly jumps from 50 V to 100 V. Then, after another long time, what is the value of  $v_o$  (10%)? How much energy is added to the capacitor from  $t=0$  to the end (5%)?



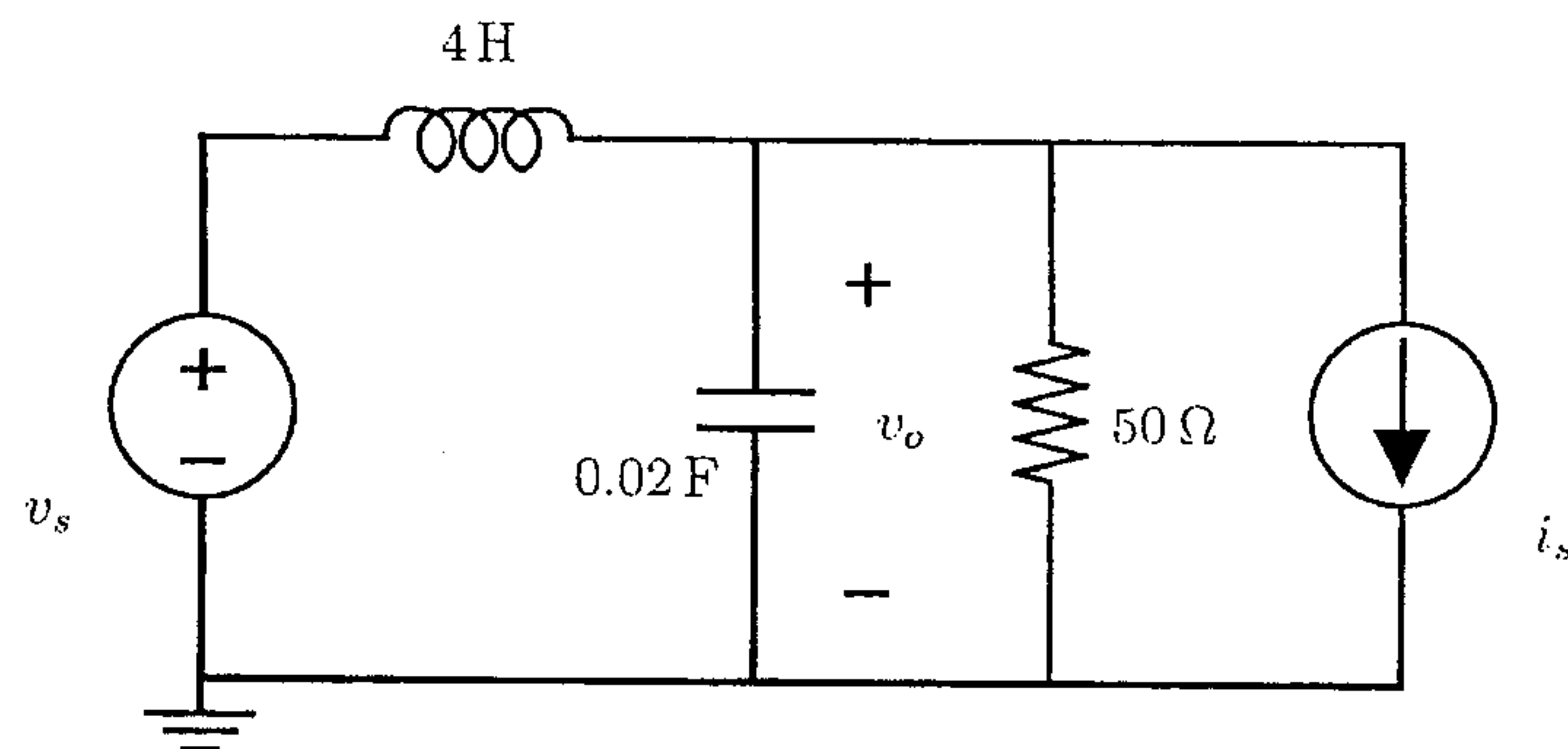
五、 (10%) Determine the Fourier series of the current function shown below. Show your works.



六、 (10%) Express the output voltage  $v_o(t)$  for the circuit below. Show your works and comment on what type of circuit it is.



七、 (10%) For the given circuit,  $v_s = 60 \cos(5t)V$ ,  $i_s = 3 \sin(2t) A$ . Find (a) the steady state time-domain expression of the voltage  $v_o$ ; (b) the RMS value of  $v_o$ ; (c) the average power consumption of the 50ohm resistor.



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八、 (10%) Please answer the following questions.

(一) (5%) Does this signal  $v(t) = e^{-t} \cos(100t)$ ; ( $0 < t < 1.0$  sec) have a phasor representation(Yes/No)? If yes, then write down its phasor. If no, explain why not.

(二) (5%) Can a light bulb consume only reactive power while emitting light (Yes/No)? Why?

參考用