UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2008/09

SUBJECT'S NAME	:	ELECTRICAL CIRCUIT THEORY
SUBJECT'S CODE	:	BEE 1113
COURSE	:	1 BEE
EXAMINATION DATE	:	APRIL 2009
DURATION	:	3 HOURS
INSTRUCTION	:	PART A ANSWER **ALL** QUESTIONS PART B ANSWER **FOUR (4)** QUESTIONS OUT OF SIX (6) QUESTIONS

THIS QUESTION PAPER CONSISTS OF THIRTEEN (13) PAGES

PART A – Question 1 to Question 4 (60 marks)

Q1 (a) A resistor with a current of 2 A through it in an amplifier circuit converts 1000 J of electrical energy in 90 s. What is the voltage across the resistor?

(3 marks)

(b) Explain how a parallel-plate capacitor stores the energy when it is connected to an electrical source. You may include diagram in your answer.

(8 marks)

Q2 (a) Using the node voltage technique to the circuit given in Figure Q2(a), calculate

(i) node voltages v_1 and v_2.

(7 marks)

(ii) current i_B.

(3 marks)

(b) Referring to the circuit given in Figure Q2(b), it is found that the current i = 4 mA when R = 2 kΩ and i = 3 mA when R = 4 kΩ.

(i) Determine the Thevenin equivalent circuit.

(6 marks)

(ii) Specify the value of R to cause i = 2 mA.

(2 marks)

(iii) Calculate the maximum power transfer to R.

(3 marks)

(iv) Determine the maximum possible value of the current i.

(2 marks)

Q3 Given portable lighting equipment for a mine is located at point A, located 100 m from its DC supply. The mine lights used a total of 5 kW and operates at 120 V.

(a) State the parameters that affect the resistance value of wire.

(3 marks)

(b) Determine the maximum cross-sectional area required of the copper wires if the power loss in copper wire is not more than 5% of power required by the mine lights. Given the resistivity of copper wire, $\rho = 1.7 \times 10^{-4}\ \Omega m$.

(7 marks)

(c) Suppose a worker that using the portable light moves further away from point A, what happen to the portable lighting wire resistance? Give **ONE (1)** reason for your answer.

(4 marks)

Q4 (a) For first-order circuit analysis, what is the difference between a natural response analysis and a step response analysis?

(6 marks)

(b) Referring to Figure Q4(b), redraw the circuit for

(i) $t < 0$.

(3 marks)

(ii) $t > 0$.

(3 marks)

PART B – Question 5 to Question 10 (40 marks)

Q5 An electroplating bath, as shown in Figure Q5, is to plate silver uniformly into objects such as kitchen ware and plates. A current of 600 A flows for 20 minutes and each coulomb transports 1.118 miligrams of silver.

(a) Calculate the supply voltage required if the process absorbs 14.4 MJ of energy.

(2 marks)

(b) What is the weight of silver deposited in grams?

(8 marks)

Q6 (a) Referring to the circuit in Figure Q6, calculate current i_a using mesh-current technique.

(8 marks)

(b) Suppose a wire is connected in parallel with the 12 A source, determine the current supplied by the dependent source.

(2 marks)

Q7 (a) Referring to the circuit in Figure Q7, determine the reading on both ammeter and voltmeter using the superposition technique.

(7 marks)

(b) Explain what will happen if the ammeter in Figure Q7 is connected in parallel with 20 kΩ resistor.

(3 marks)

Q8 Referring to circuit in Figure Q8, the voltage supply is given as $v(t) = 4\cos 3t$ V.

(a) How do inductor voltage expressed in term of inductor current?

(2 marks)

(b) Find the equivalent inductance in term of L.

(4 marks)

(c) Given the value of L = 0.04 H, calculate the value of current $i(t)$.

(4 marks)

Q9 A typical charging circuit for control system is given in Figure Q9.

(a) What is the response produced by this circuit?

(1 mark)

(b) Determine $v(t)$ for $t \geq 0$.

(6 marks)

(c) If the 4 kΩ resistor becomes short-circuit, does the initial capacitor voltage change? Give **ONE (1)** reason for your answer.

(3 marks)

Q10 A second-order RLC circuit with double switches, T1 and T2, is given in Figure Q10.

(a) What happen when switch T2 is closed?

(2 marks)

(b) Calculate both initial inductor current and initial capacitor voltage.

(2 marks)

(c) Determine the solution produce by this circuit, final inductor current and final capacitor voltage.

(6 marks)

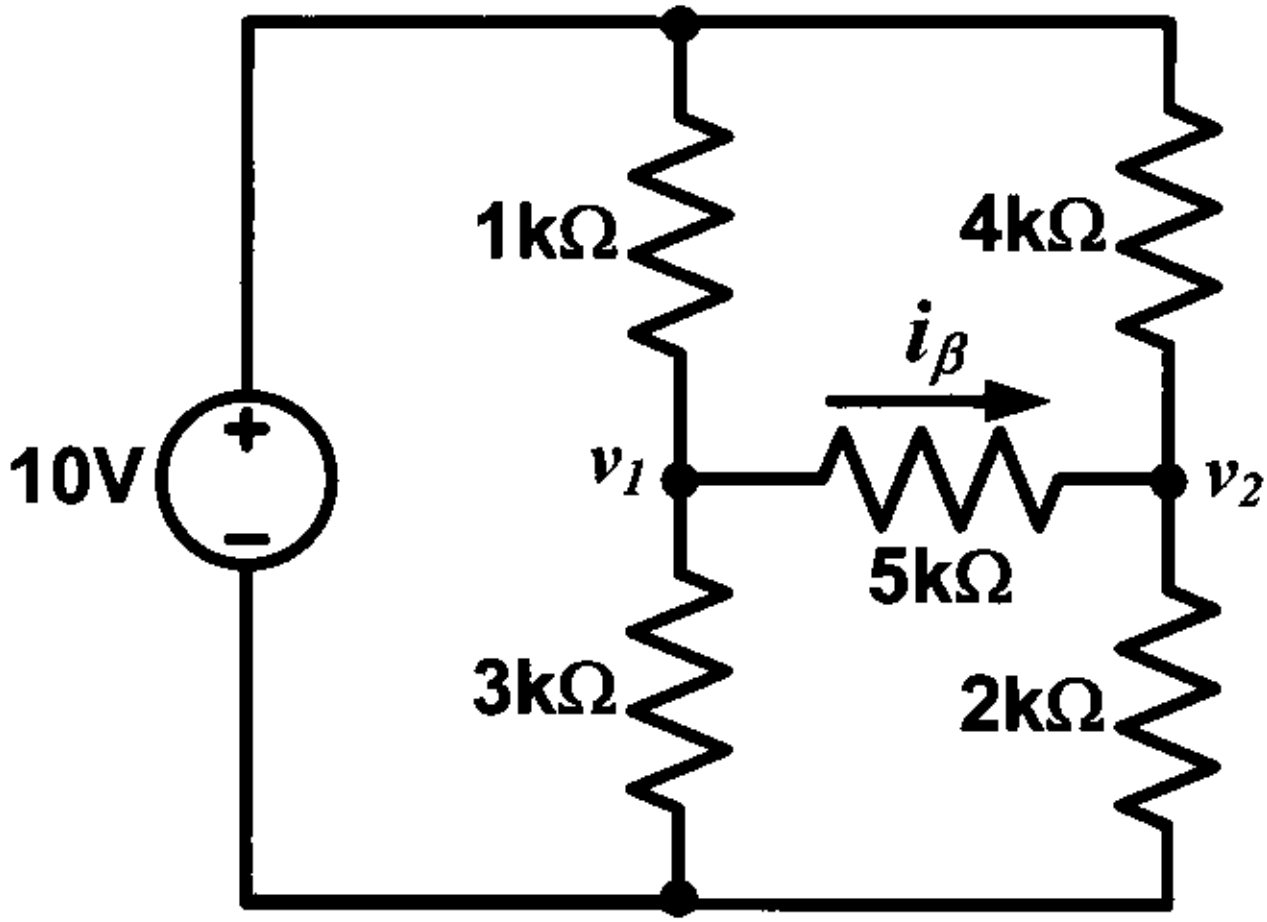

FIGURE Q2(a)

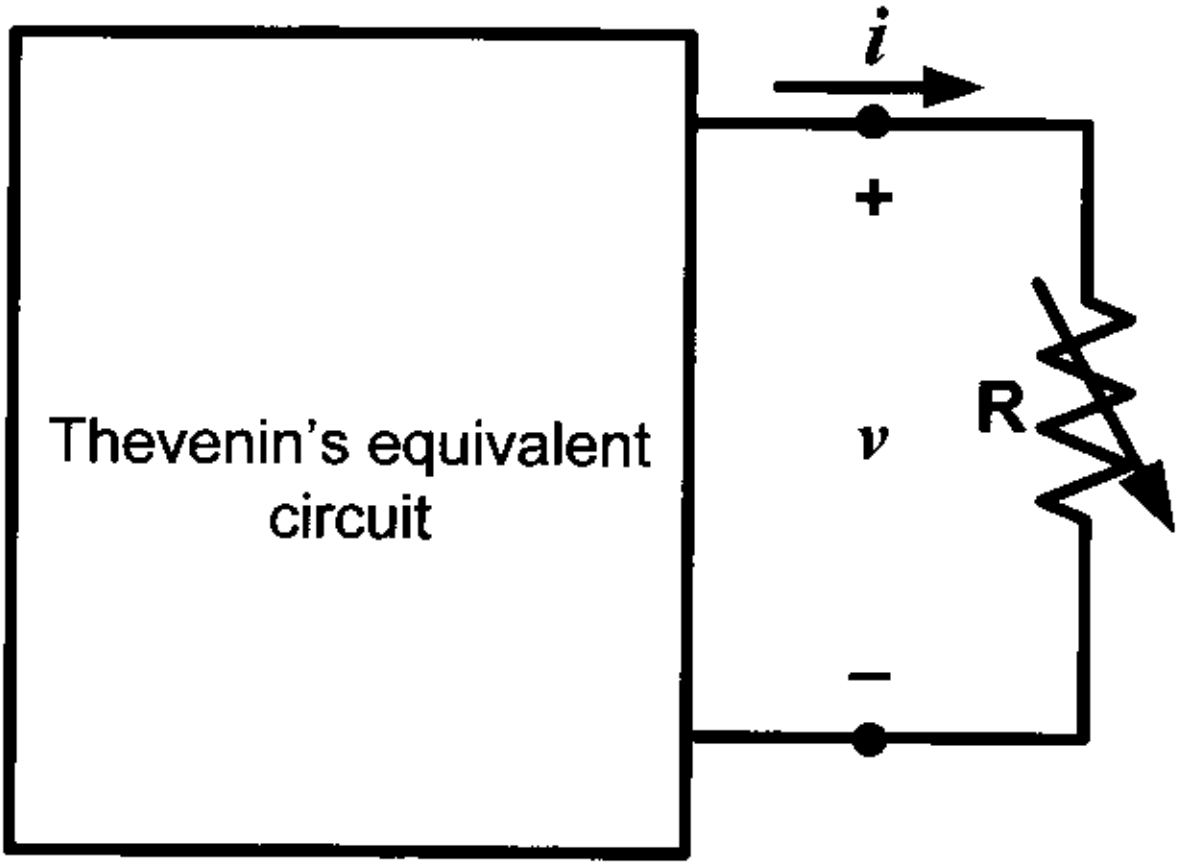

FIGURE Q2(b)

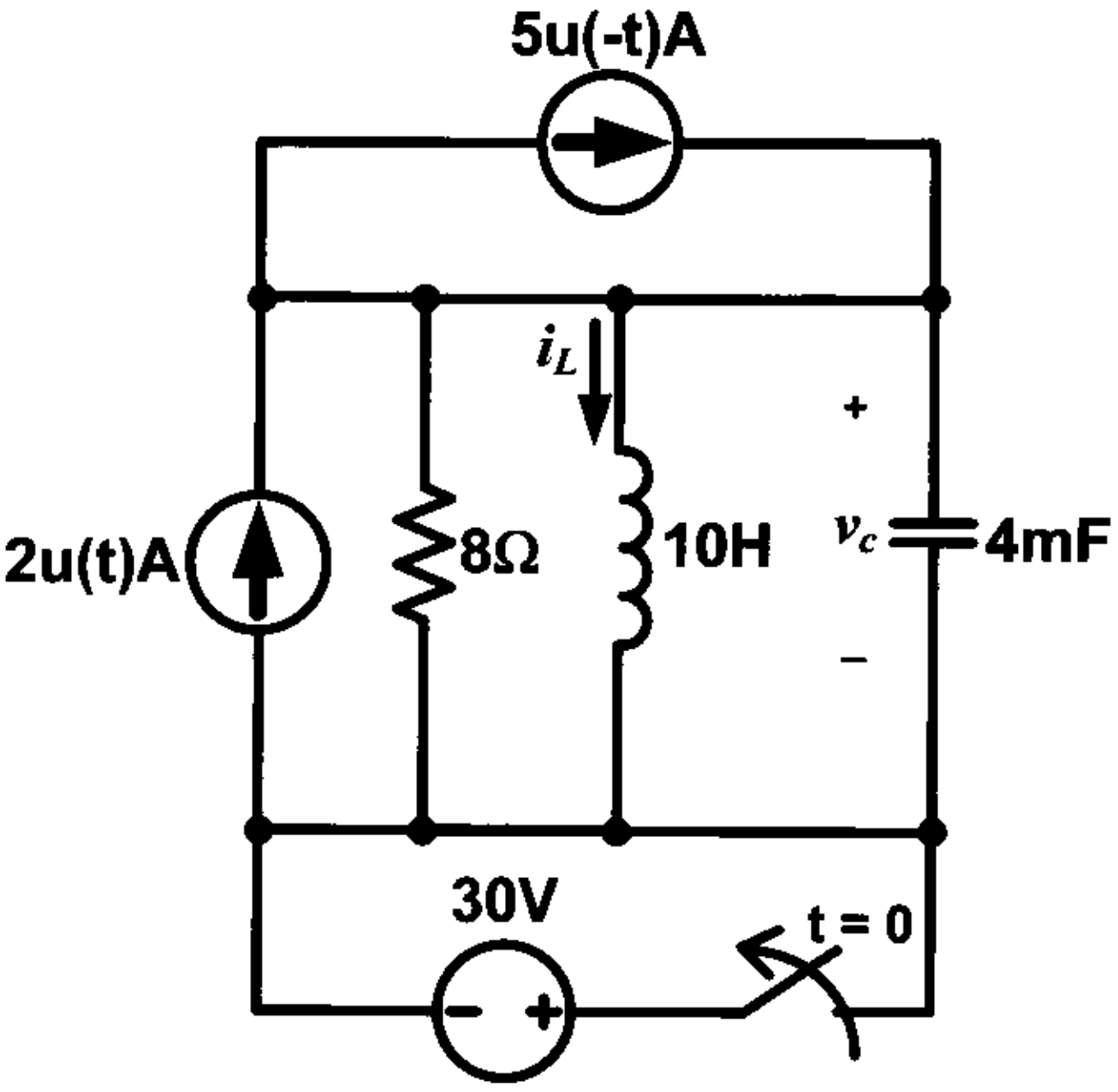

FIGURE Q4(b)

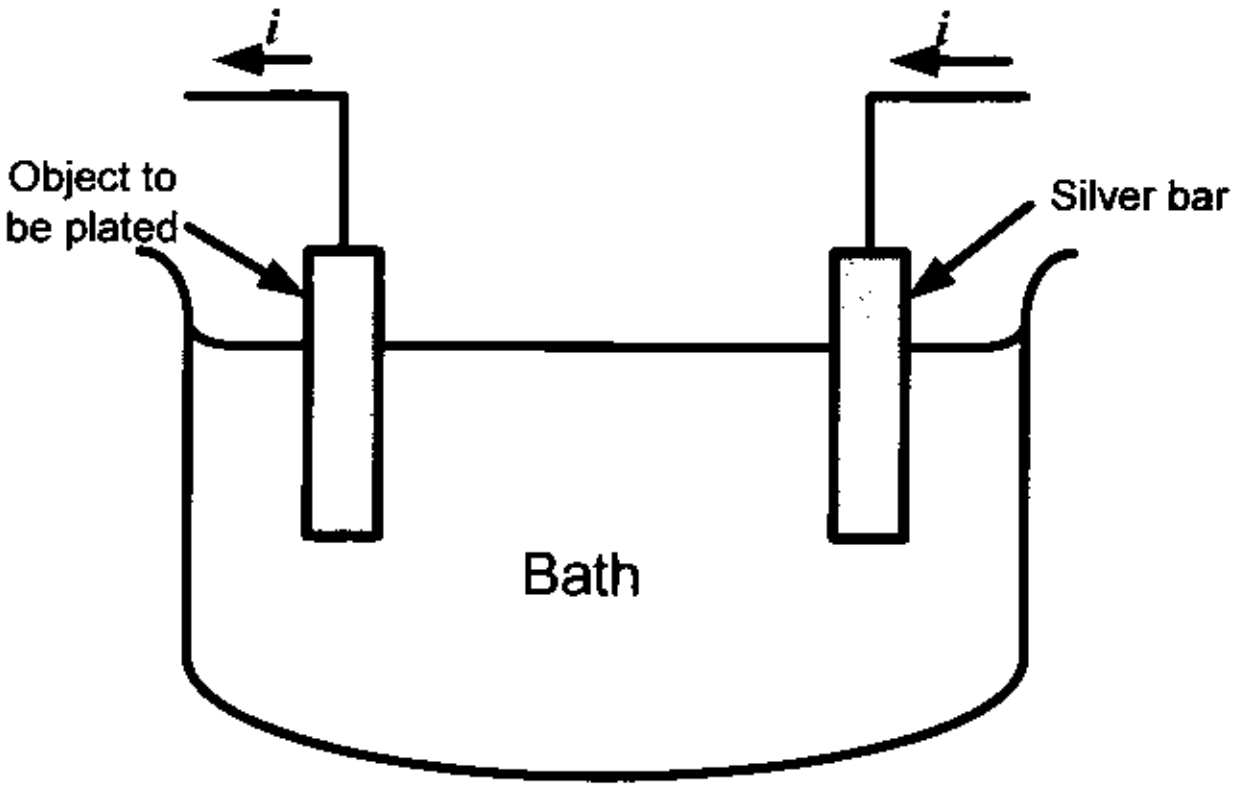

FIGURE Q5

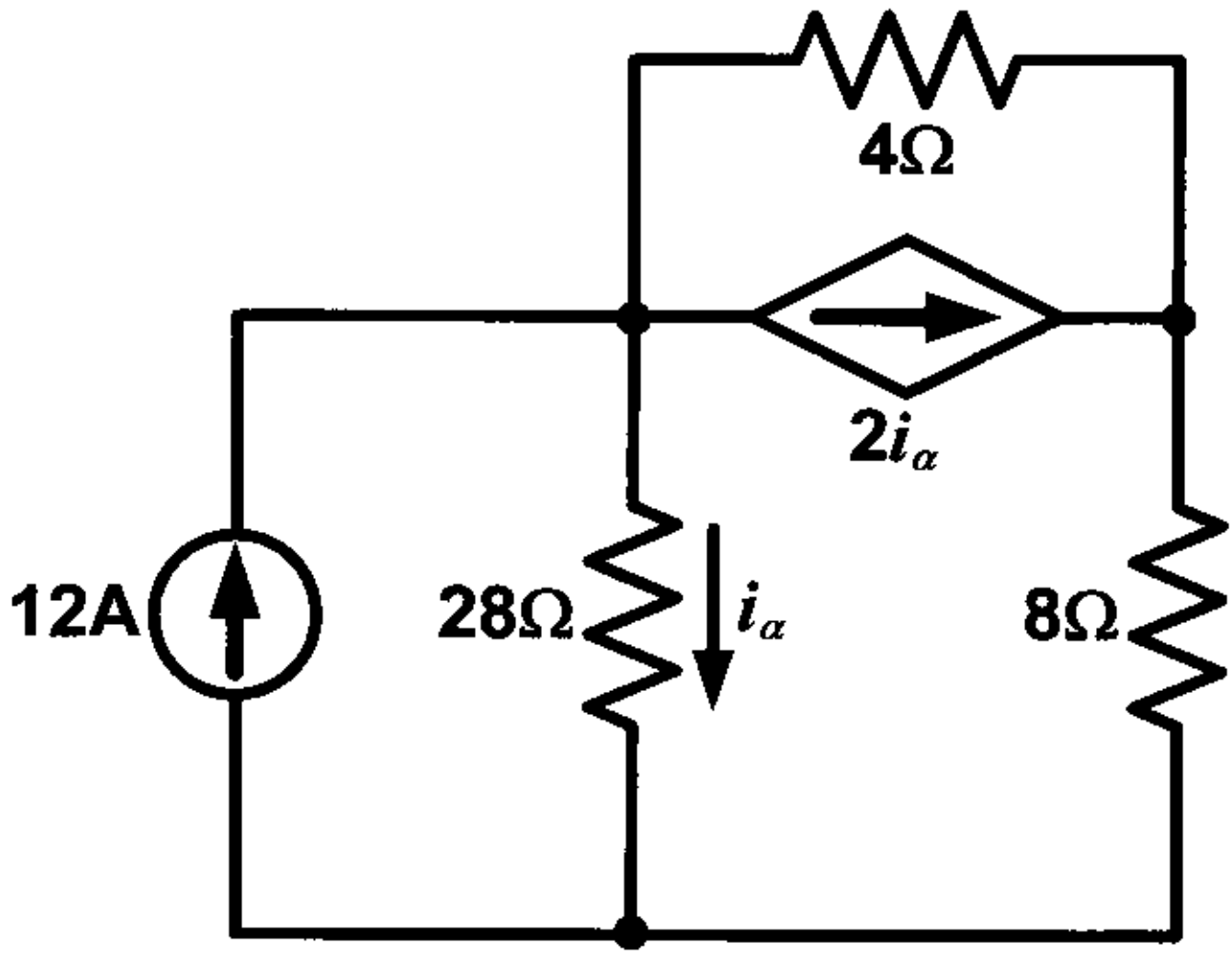

FIGURE Q6

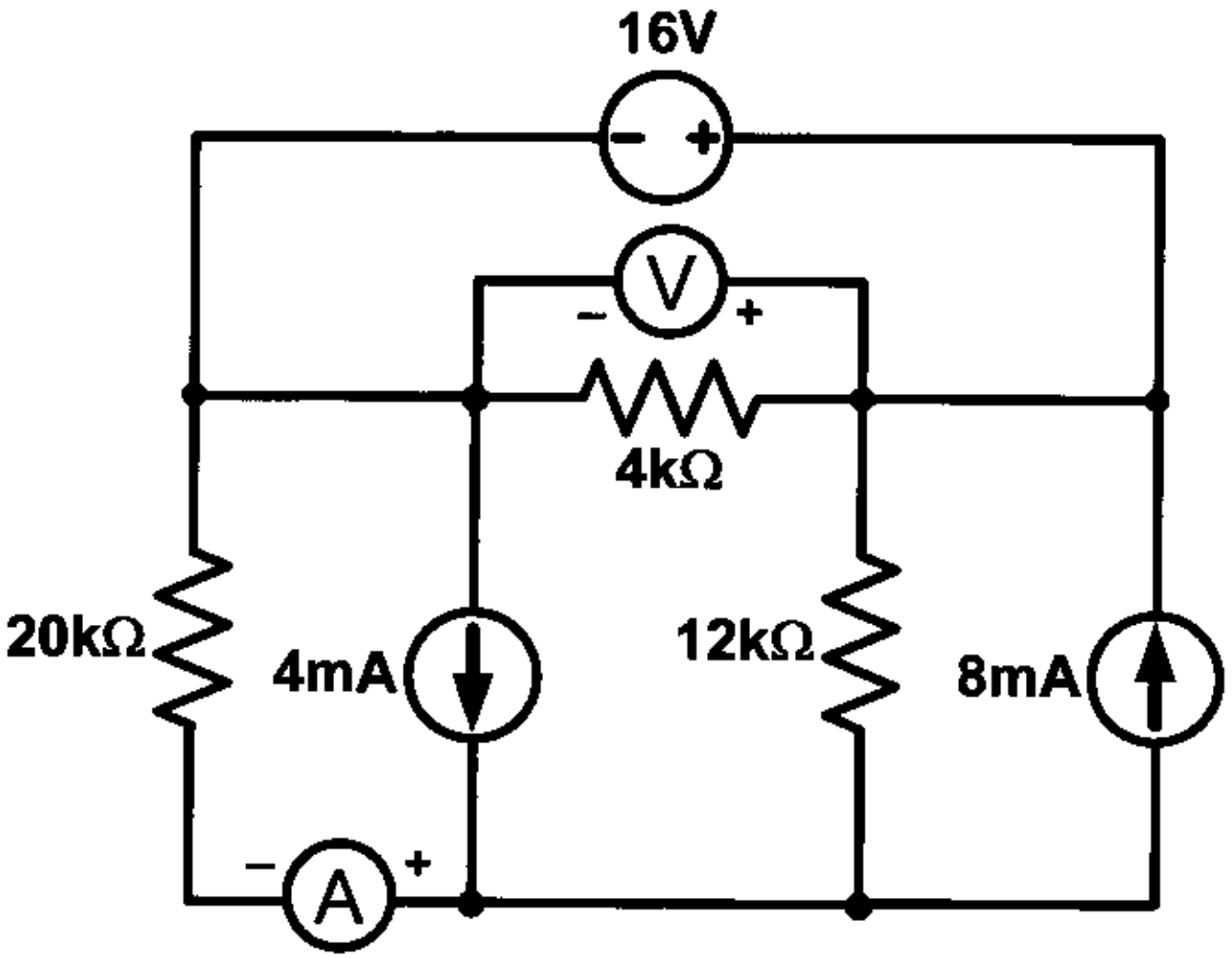

FIGURE Q7

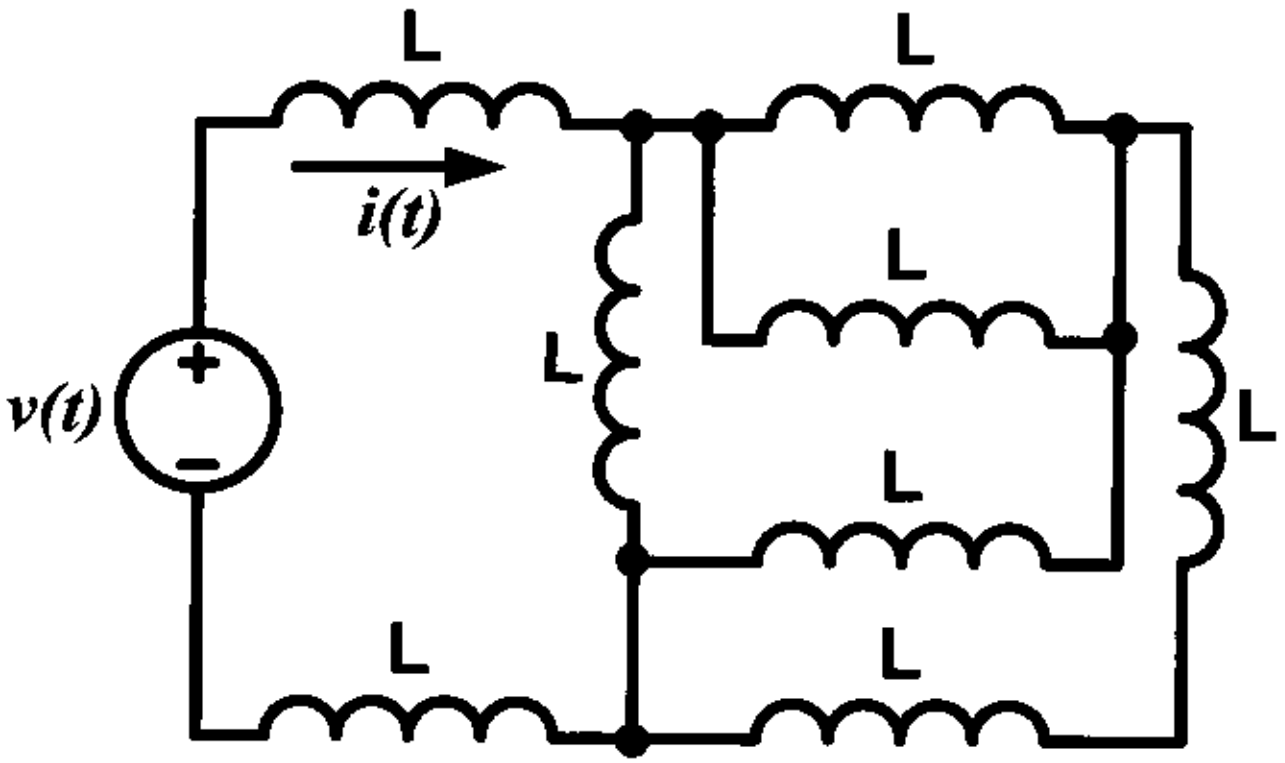

FIGURE Q8

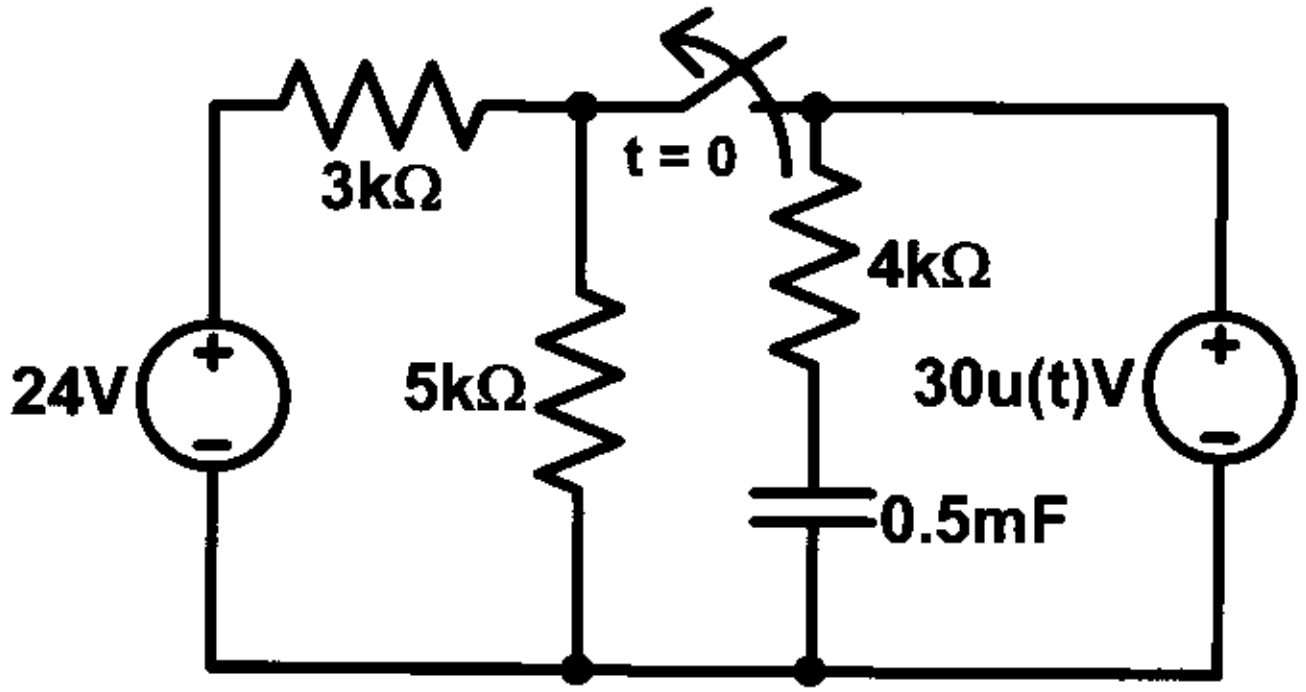

FIGURE Q9

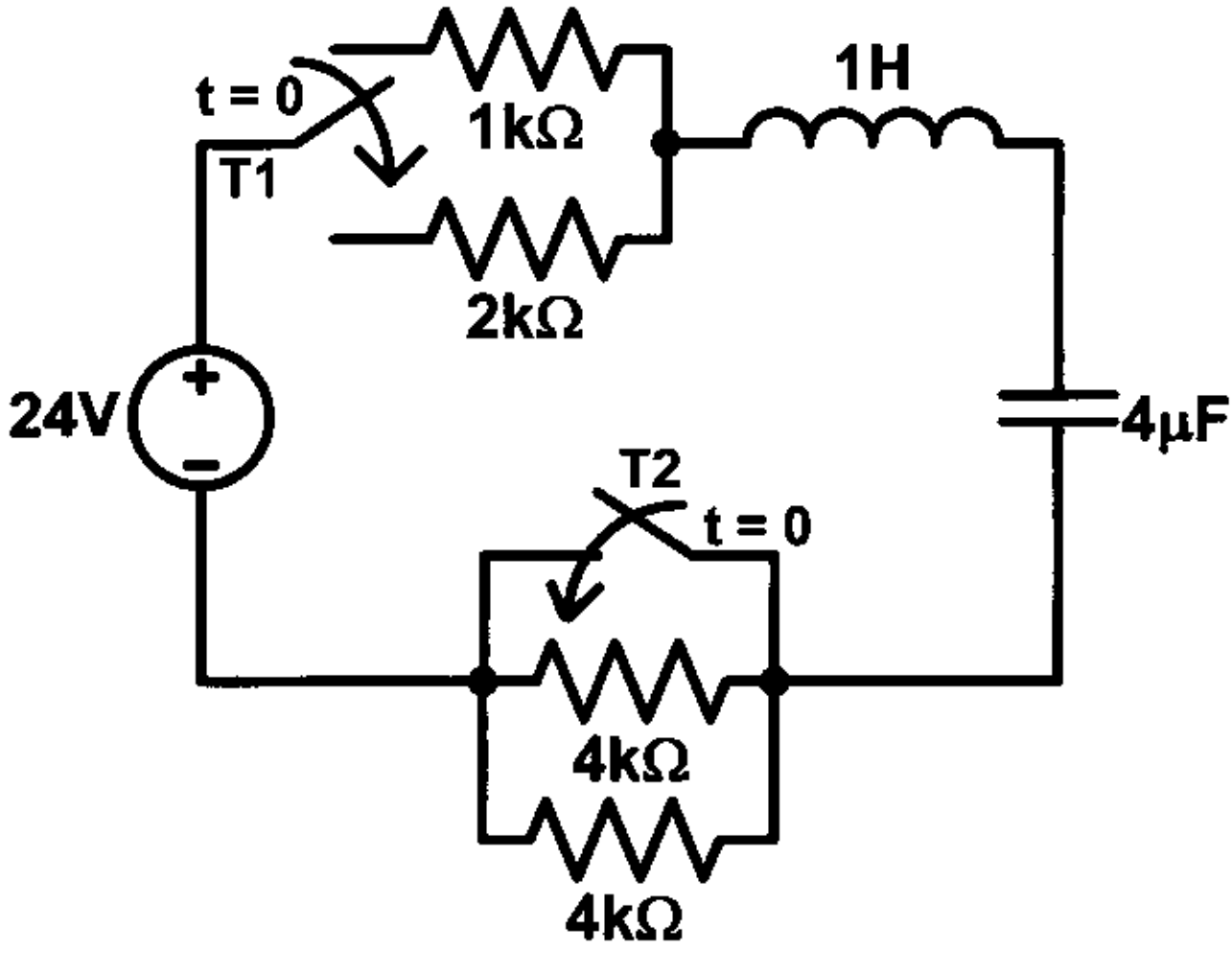

FIGURE Q10