

**ELEC2070 2023 Assignment 2 Questions**  
(Solve at Home and Submit to iLearn by the due date)



Total 80 marks. PLEASE USE NEAT HANDWRITING. Assignments with poor handwriting will not be marked.

1. (10 marks) For the circuit in Fig. 1, the switch has been closed for a long time prior to  $t=0$ .
  - a) Determine the values of  $i_L(t)$  just before  $t=0$  and a long time after  $t=0$ .
  - b) Determine the time constant after the switch opens and the expression for  $i_L(t)$ .
  - c) Find  $i_L(t)$  for  $t=15.8 \mu\text{s}$ ,  $t=31.5 \mu\text{s}$  and  $78.8 \mu\text{s}$

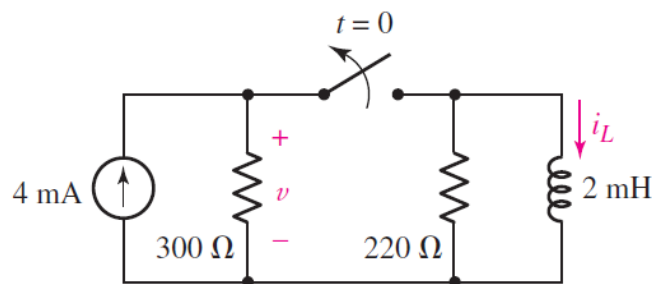


Fig. 1

2. (10 marks) The switch shown in Fig. 2 has been closed for a long time prior to  $t=0$ , then it opens at  $t=0$ .
  - a) Find  $v(0^+)$
  - b) Find the expression for  $v(t)$  for  $t>0$ .
  - c) Calculate the voltage  $v(t)$  for  $t = \tau, 2\tau, 5\tau$
  - d) Sketch  $v(t)$  to scale versus time for  $-\tau \leq t \leq 5\tau$  s.

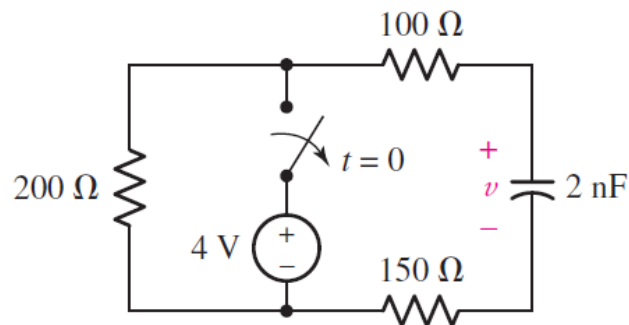


Fig. 2

3. (15 marks) Consider the circuit shown in Fig. 3. Obtain expressions for both  $i_1(t)$  and  $i_L(t)$  for  $t>0$ .

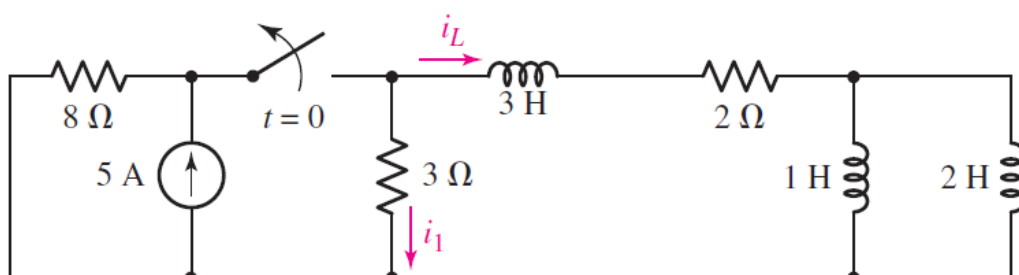


Fig. 3

4. (10 marks) Consider the circuit shown in Fig. 4. (a) Obtain an expression for  $v_C(t)$  for all values of  $t$ .  
 (b) Sketch  $v_C(t)$  over the range  $0 \leq t \leq 4 \mu\text{s}$ .

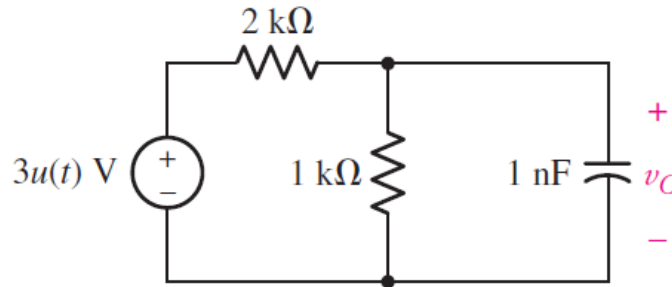


Fig. 4

5. (15 marks) A motor coil having an inductance of 8 H is in parallel with a  $2 \mu\text{F}$  capacitor and a resistor of unknown value. The response of the circuit is determined to be critically damped. (a) Determine the value of the resistor. (b) Compute  $\alpha$ . (c) Write the equation for the current flowing into the resistor if the top node is labelled  $v$ , the bottom node is grounded, and  $v = R i_R$ . (d) Verify that your equation is a solution to the circuit differential equation

$$\frac{d^2 i_R}{dt^2} + 2\alpha \frac{di_R}{dt} + \alpha^2 i_R = 0$$

6. (20 marks) Determine  $i(t)$  for  $t > 0$  for the circuit in Fig. 5.

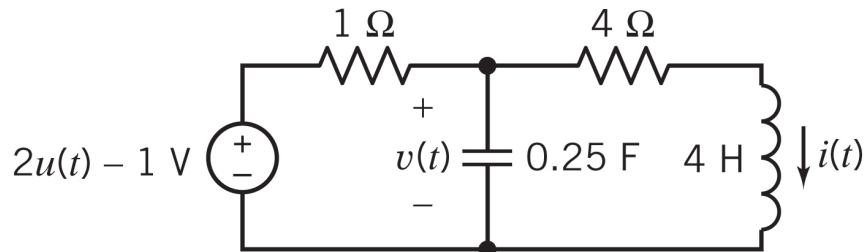


Fig. 5