

GEORGIA INSTITUTE OF TECHNOLOGY  
School of Electrical and Computer Engineering

Course ECE 2040  
Circuit Analysis

Assigned: March 2, 2001  
Due: March 16, 2001

Problem Set #8

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**Reading:** Read the following sections from the class notes:  
Chapter 6, Sections 6.1, 6.2

**Reading:** Some of same topics are discussed in Dorf and Svoboda:  
Chapter 8, Sections 8.3, 8.7 (analyzing circuits with differential equations)  
Chapter 14, Sections 14.6, 14.7 (analyzing circuits with Laplace transforms)

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**Problem 8.1:** In the circuit of Figure 1 the source voltage is  $v_s(t) = e^{-2t}$  for  $t > 0$  and  $v_c(0) = 1$  V.

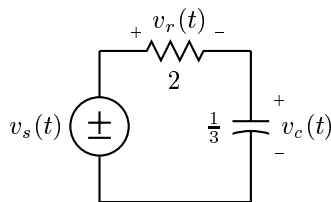


Figure 1: Circuit for Problem 8.1.

- (a) Write the differential equation whose solution is the equilibrium solution for  $v_c(t)$ .
- (b) Write the differential equation whose solution is the equilibrium solution for  $v_r(t)$  and determine the value of  $v_r(0)$ .

**Problem 8.2:** Determine  $v_{out}(t)$  for  $t > 0$  for the circuit in Figure 2 if  $v_{out}(0) = 0$ .

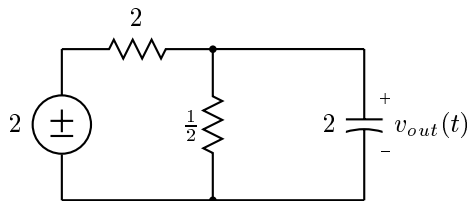


Figure 2: Circuit for Problem 8.2.

**Problem 8.3:** For the circuit shown in Figure 3.

- (a) Find  $v_r(t)$  for  $t > 0$  if  $i_\ell(0) = 0$ .  
 (b) Find  $v_r(t)$  for  $t > 0$  if  $i_\ell(0) = 5$ .

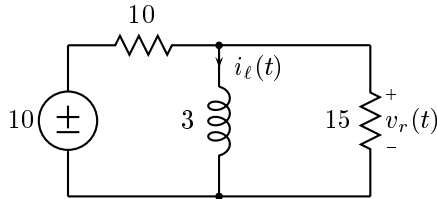


Figure 3: Circuit for Problem 8.3.

**Problem 8.4:** For the circuit in Figure 4, let  $i_s(t) = 1$  for  $t > 0$  and assume that at  $t = 0$  the current through the inductor is zero and that the voltage drop across the capacitor terminals is 1 volt.

- (a) Redraw the circuit in the Laplace domain.  
 (b) Determine  $V(s)$ , the Laplace transform of the resistor voltage.  
 (c) Determine  $v(t)$  for  $t > 0$ .

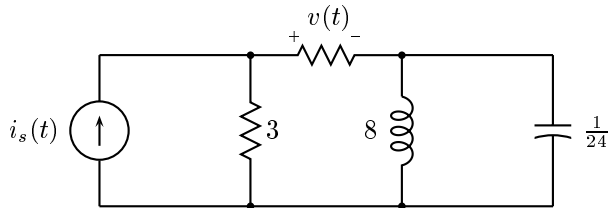


Figure 4: Circuit for Problem 8.4.

**Problem 8.5:** In the circuit in Figure 5 solve for  $v(t)$  for  $t > 0$ . Assume that the circuit is at initial rest.

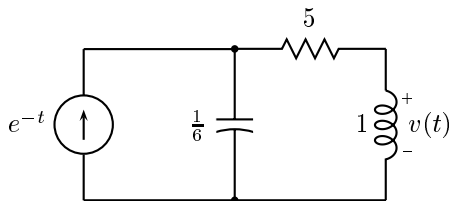


Figure 5: Circuit for Problem 8.5.

**Problem 8.6:** In the circuit below,  $v_c(0) = 8\text{V}$  and  $i_\ell(0) = 4\text{A}$ . Find  $i_\ell(t)$  for  $t > 0$ .

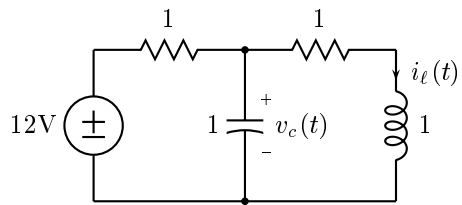


Figure 6: Circuit for Problem 8.6.