دانشگاه سمنان

Semnan University
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دانشکده مهندسی مکانیک

دانشکده مهندسی مکانیک

تمرین درس مبانی برق ۱

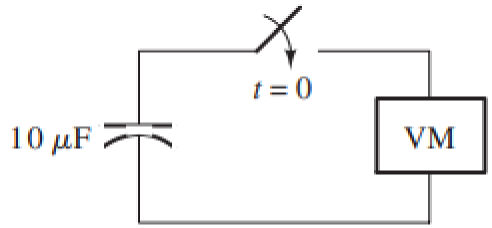
نام و شماره دانشجویی:

Introduction to Electrical Engineering Exercises

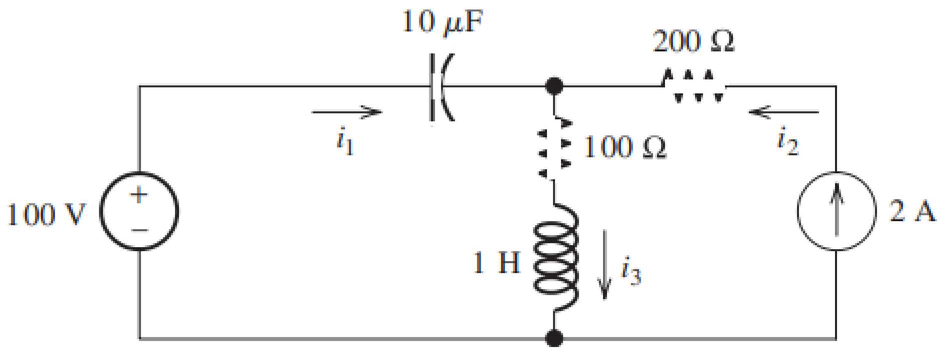
Chapter 4 – Transients

*****P4.4.** A 100-μF capacitance is initially charged to 1000 V. At $t = 0$, it is connected to a 1-kΩ resistance. At what time t_2 has 50 percent of the initial energy stored in the capacitance been dissipated in the resistance?

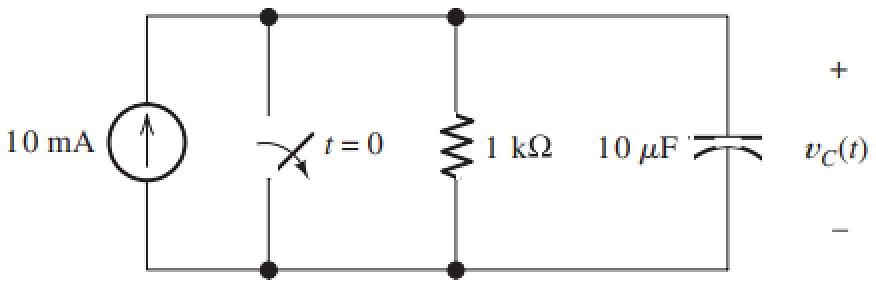
***P4.5.** At $t = 0$, a charged 10-μF capacitance is connected to a voltmeter, as shown in Figure P4.5. The meter can be modeled as a resistance. At $t = 0$, the meter reads 50 V. At $t = 30$ s, the reading is 25 V. Find the resistance of the voltmeter.



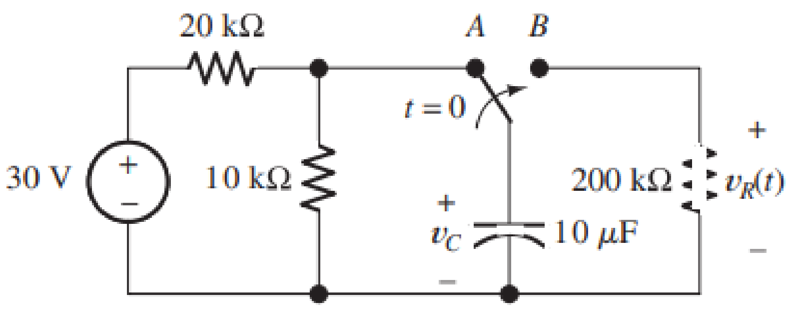
***P4.21.** Solve for the steady-state values of i_1, i_2, and i_3 for the circuit shown in Figure P4.21.



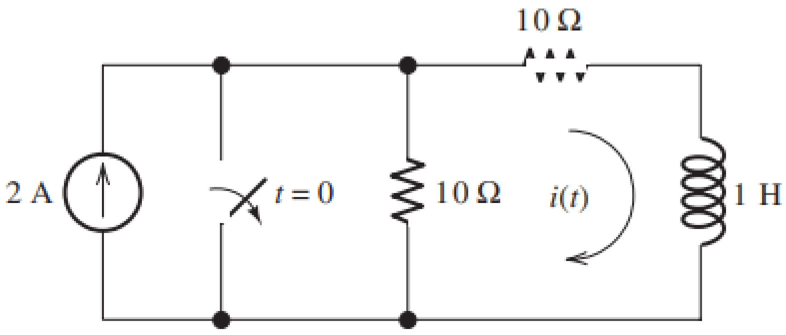
***P4.22.** Consider the circuit shown in Figure P4.22. What is the steady-state value of v_C after the switch opens? Determine how long it takes after the switch opens before v_C is within 1 percent of its steady-state value.



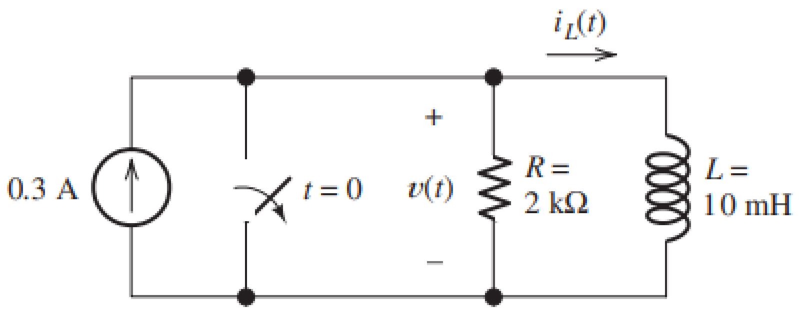
***P4.23.** In the circuit of Figure P4.23, the switch is in position *A* for a long time prior to $t = 0$. Find expressions for $v_R(t)$ and sketch it to scale for $-2 \le t \le 10$ s.



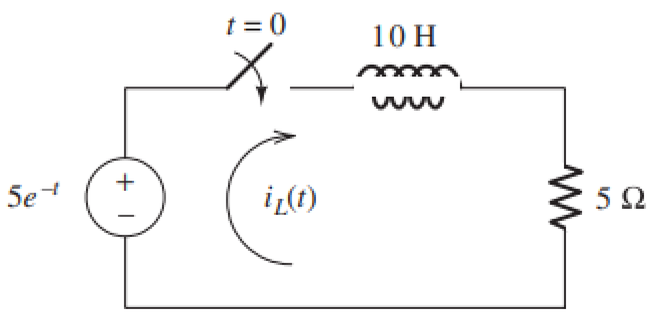
***P4.33.** The circuit shown in Figure P4.33 is operating in steady state with the switch closed prior to $t = 0$. Find $i(t)$ for $t < 0$ and for $t \geq 0$.



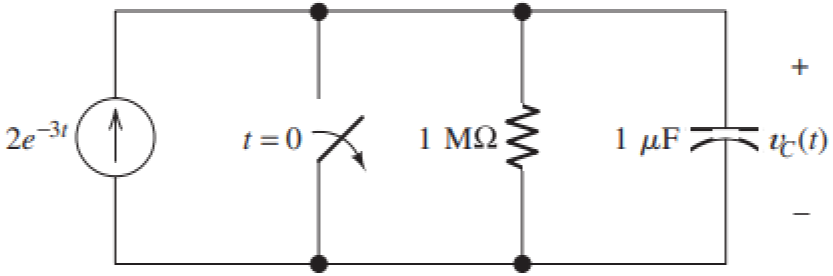
***P4.34.** Consider the circuit shown in Figure P4.34. The initial current in the inductor is $i_L(0-) = -0.2$ A. Find expressions for $i_L(t)$ and $v(t)$ for $t \geq 0$ and sketch to scale versus time.



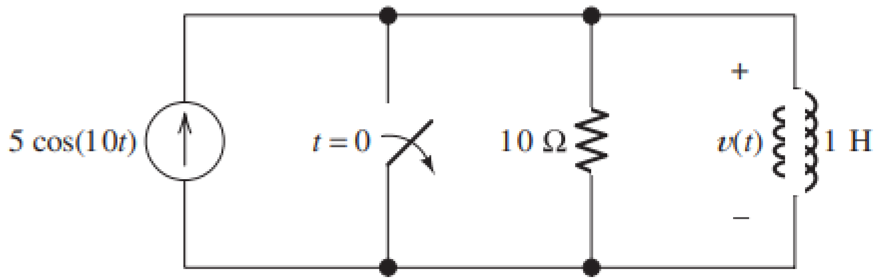
***P4.45.** Write the differential equation for $i_L(t)$ and find the complete solution for the circuit of Figure P4.45. [*Hint:* Try a particular solution of the form $i_{Lp}(t) = Ae^{-t}$.]



***P4.46.** Solve for $v_C(t)$ for $t > 0$ in the circuit of Figure P4.46. [*Hint:* Try a particular solution of the form $v_{Cp}(t) = Ae^{-3t}$.]



***P4.47.** Solve for $v(t)$ for $t > 0$ in the circuit of Figure P4.47, given that the inductor current is zero prior to $t = 0$. [*Hint:* Try a particular solution of the form $v_p = A\cos(10t) + B\sin(10t)$.]



***P4.61.** A dc source is connected to a series *RLC* circuit by a switch that closes at $t = 0$, as shown in Figure P4.61. The initial conditions are $i(0+) = 0$ and $v_C(0+) = 0$. Write the differential equation for $v_C(t)$. Solve for $v_C(t)$, if $R = 80\ \Omega$.

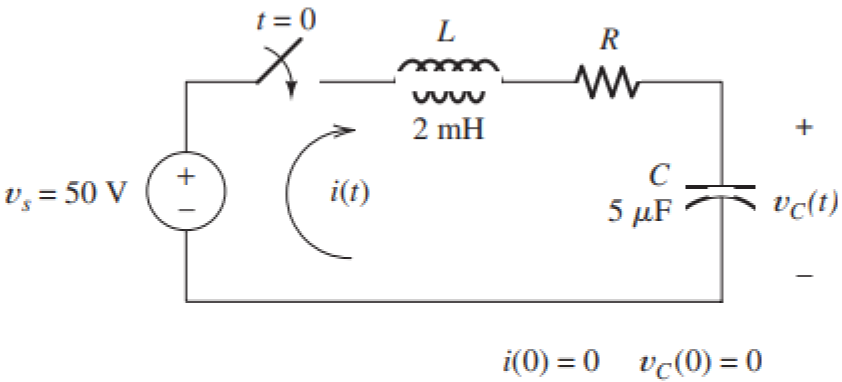
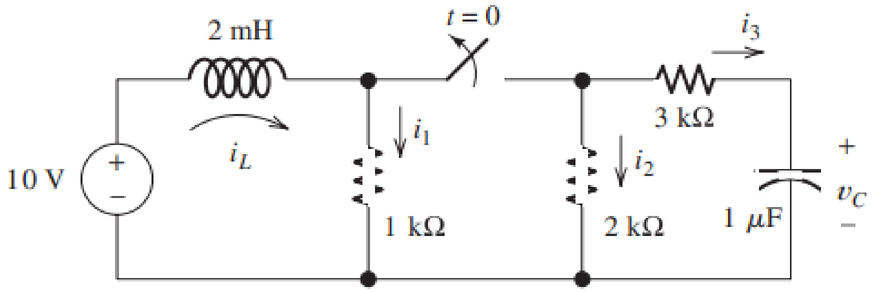


Figure P4.61

***P4.62.** Repeat Problem P4.61 for $R = 40\ \Omega$.

***P4.63.** Repeat Problem P4.61 for $R = 20\ \Omega$.

T4.1. Consider the circuit shown in Figure T4.1. The circuit has been operating for a long time with the switch closed prior to $t = 0$. **a.** Determine the values of i_L, i_1, i_2, i_3, and v_C just before the switch opens. **b.** Determine the values of i_L, i_1, i_2, i_3, and v_C immediately after the switch opens. **c.** Find $i_L(t)$ for $t > 0$. **d.** Find $v_C(t)$ for $t > 0$.



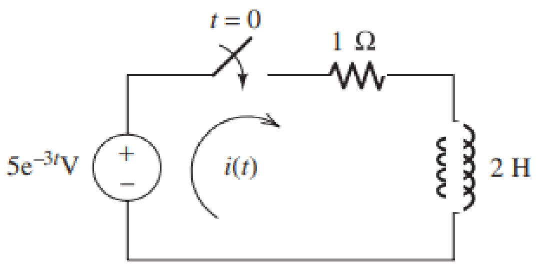
T4.2. Consider the circuit shown in Figure T4.2.

a. Write the differential equation for $i(t)$.

b. Find the time constant and the form of the complementary solution.

c. Find the particular solution.

d. Find the complete solution for $i(t)$.



T4.3. Consider the circuit shown in Figure T4.3 in which the initial inductor current and capacitor voltage are both zero.

a. Write the differential equation for $v_C(t)$.

b. Find the particular solution.

c. Is this circuit overdamped, critically damped, or underdamped? Find the form of the complementary solution.

d. Find the complete solution for $v_C(t)$.