دانشکده مهندسی مکانیک

تمرین درس مبانی برق ۱

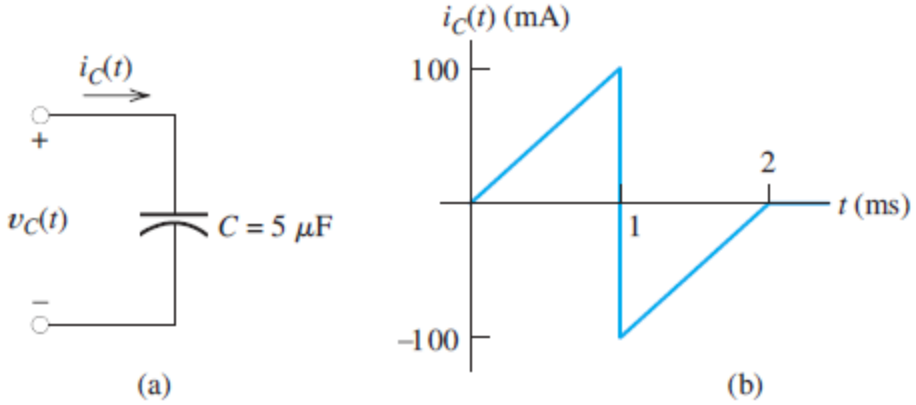
نام و شماره دانشجویی:

Introduction to Electrical Engineering Exercises

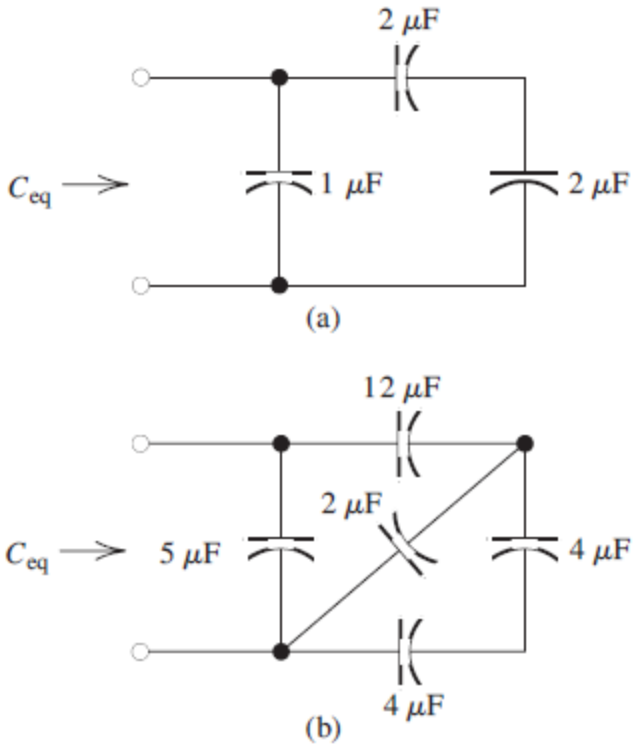
Chapter 3 – Inductance and Capacitance

***P3.5.** A 2000-μF capacitor, initially charged to 100 V, is discharged by a steady current of 100 μA. How long does it take to discharge the capacitor to 0 V?

P3.16. The current through a 5-μF capacitor is shown in Figure P3.16. At $t = 0$, the voltage is $v_C(0) = 0$ V. Sketch the voltage, power, and stored energy to scale versus time.

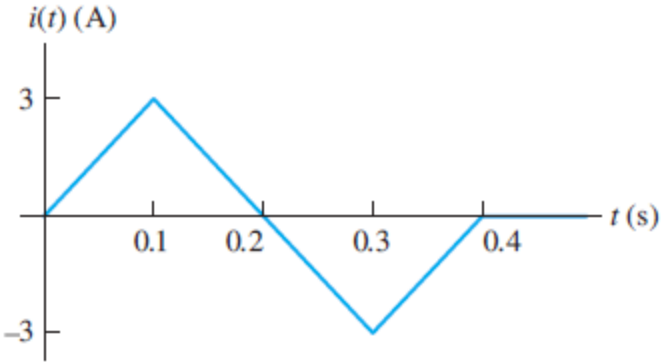


***P3.24.** Find the equivalent capacitance for each of the circuits shown in Figure P3.24.

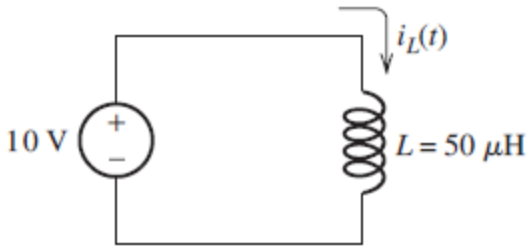


***P3.32.** Suppose that we have a 1000-pF parallel-plate capacitor with air dielectric charged to 1000 V. The capacitor terminals are open circuited. Find the stored energy. If the plates are moved farther apart so that d is doubled, determine the new voltage on the capacitor and the new stored energy. Where did the extra energy come from?

***P3.43.** The current flowing through a 2-H inductance is shown in Figure P3.43. Sketch the voltage, power, and stored energy versus time.

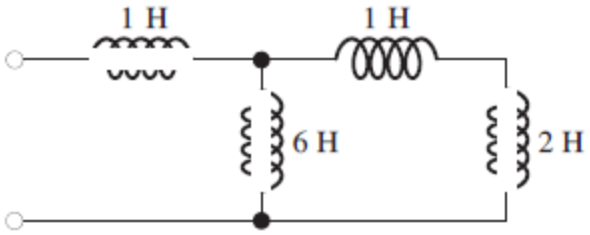


***P3.44.** A constant voltage of 10 V is applied to a 50-μH inductance, as shown in Figure P3.44. The current in the inductance at $t = 0$ is -100 mA. At what time t_x does the current reach $+100$ mA?

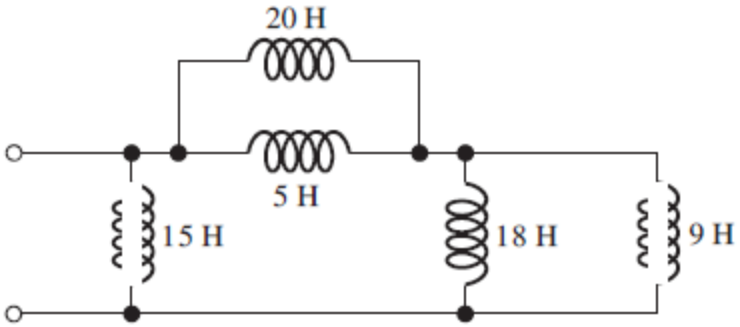


***P3.45.** At $t = 0$, the current flowing in a 0.5-H inductance is 4 A. What constant voltage must be applied to reduce the current to 0 at $t = 0.2$ s?

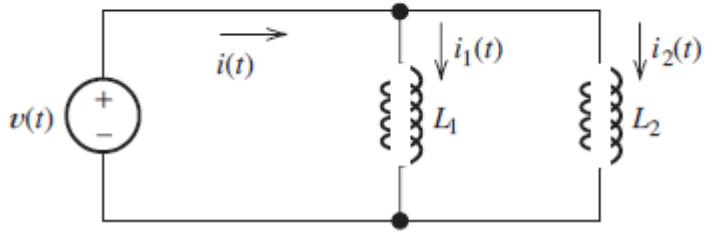
***P3.60.** Determine the equivalent inductance for each of the series and parallel combinations shown in Figure P3.60.



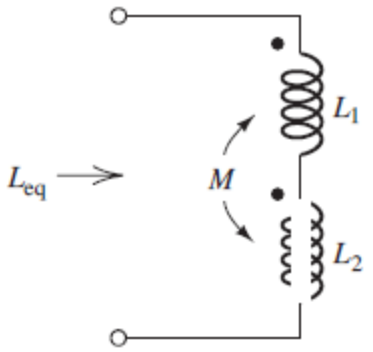
(a)



***P3.61.** Two inductances $L_1 = 1\,\text{H}$ and $L_2 = 2\,\text{H}$ are connected in parallel as shown in Figure P3.61. The initial currents are $i_1(0) = 0$ and $i_2(0) = 0$. Find an expression for $i_1(t)$ in terms of $i(t)$, L_1, and L_2. Repeat for $i_2(t)$. Comment.

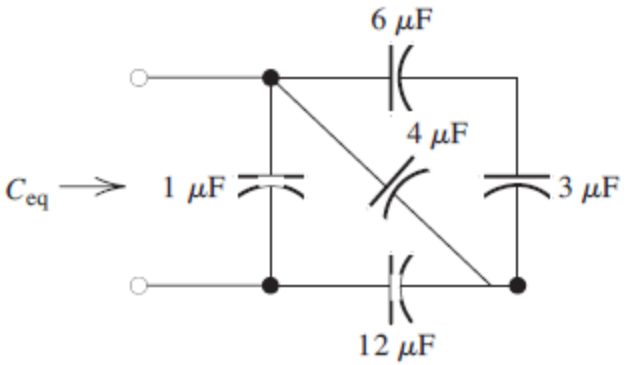


*P3.72. **a.** Derive an expression for the equivalent inductance for the circuit shown in Figure P3.72. **b.** Repeat if the dot for L_2 is moved to the bottom end.



T3.1. The current flowing through a 10-μF capacitor having terminals labeled a and b is $i_{ab} = 0.3\exp(-2000t)$ A for $t \geq 0$. Given that $v_{ab}(0) = 0$, find an expression for $v_{ab}(t)$ for $t \geq 0$. Then, find the energy stored in the capacitor for $t = \infty$.

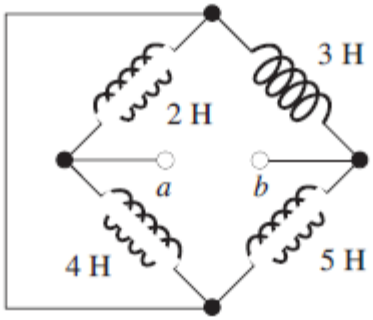
T3.2. Determine the equivalent capacitance C_{eq} for Figure T3.2.



T3.3. A certain parallel-plate capacitor has plate length of 2 cm and width of 3 cm. The dielectric has a thickness of 0.1 mm and a relative dielectric constant of 80. Determine the capacitance.

T3.4. A 2-mH inductance has $i_{ab} = 0.3\sin(2000t)$ A. Find an expression for $v_{ab}(t)$. Then, find the peak energy stored in the inductance.

T3.5. Determine the equivalent inductance L_{eq} between terminals a and b in Figure T3.5.



T3.6. Figure T3.6 has $L_1 = 40\,\text{mH}$, $M = 20\,\text{mH}$, and $L_2 = 30\,\text{mH}$. Find expressions for $v_1(t)$ and $v_2(t)$.