Electrical Engineering

HW 3 – Chapter 4

<1>

4.2 For each case shown below, derive the expression for the current through a 200-μF capacitor. $v_C(t)$ is the voltage across the capacitor.

a. $v_C(t) = 22\cos(20t - \frac{\pi}{3})$ V

b. $v_C(t) = -40\cos(90t + \frac{\pi}{2})$ V

c. $v_C(t) = 28\cos(15t + \frac{\pi}{8})$ V

d. $v_C(t) = 45\cos(120t + \frac{\pi}{4})$ V

<2>

4.4 In the circuit shown in Figure P4.4, assume $R = 1\,\Omega$ and $L = 2$ H. Also, let:

$$i(t) = \begin{cases} 0 & -\infty < t < 0 \\ t & 0 \le t < 10\text{ s} \\ 10 & 10\text{ s} \le t < \infty \end{cases}$$

Find the energy stored in the inductor for all time.

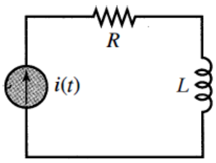

Figure P4.4

<3>

4.14 The current through a 16-μH inductor is zero at $t = 0$, and the voltage across the inductor (shown in Figure P4.14) is:

$$v(t) = \begin{cases} 0 & t \le 0 \\ 3t^2 & 0 \le t \le 20\,\mu\text{s} \\ 1.2\text{ nV} & t \ge 20\,\mu\text{s} \end{cases}$$

Determine the current through the inductor at $t = 30\,\mu$s.

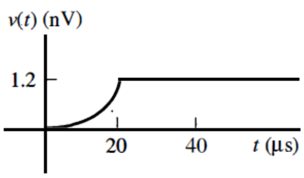

Figure P4.14

<4>

4.35 Assume steady-state conditions and find the energy stored in each capacitor and inductor shown in Figure P4.35.

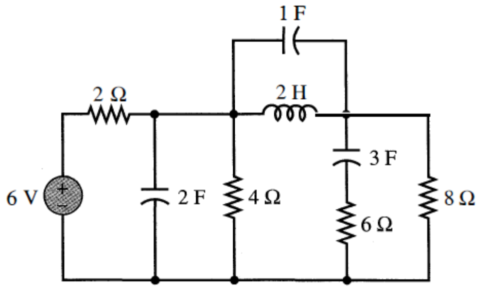

Figure P4.35

<5>

4.37 Find the phasor form of the following functions:

a. $v(t) = 155\cos(377t - 25°)$ V

b. $v(t) = 5\sin(1{,}000t - 40°)$ V

c. $i(t) = 10\cos(10t + 63°) + 15\cos(10t - 42°)$ A

d. $i(t) = 460\cos(500\pi t - 25°)$
$\quad - 220\sin(500\pi t + 15°)$ A

<6>

4.47 Determine the equivalent impedance seen by the source v_S in Figure P4.47 when:

$$v_S(t) = 10\cos(4{,}000t + 60°)\text{ V}$$
$$R_1 = 800\text{ mH}, \Omega \qquad R_2 = 500\text{ nF}\,\Omega$$
$$L = 200\text{ mH} \qquad C = 70\text{ nF}$$

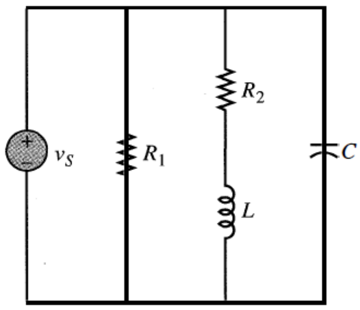

Figure P4.47

<7>

4.51 Determine the voltage $v_2(t)$ across R_2 in the circuit of Figure P4.51.

$$i(t) = 20\cos(533.33t)\ \text{A}$$
$$R_1 = 8\ \Omega \qquad R_2 = 16\ \Omega$$
$$L = 15\ \text{mH} \qquad C = 117\ \mu\text{F}$$

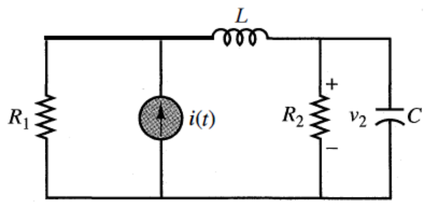

Figure P4.51

<8>

4.70 Determine the Thévenin equivalent network seen by the load R_o in Figure P4.70. Assume:

$$R_S = R_o = 500\ \Omega \qquad L = 10\,\text{mH} \qquad R = 1\,\text{k}\Omega$$

and:

a. $v_S(t) = 10\cos(1{,}000t)$

b. $v_S(t) = 10\cos(1{,}000{,}000t)$

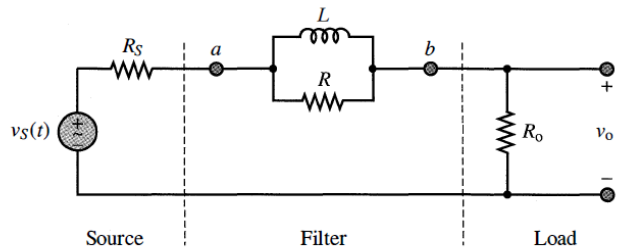

Figure P4.70

<9>

4.74 Use nodal analysis to determine the node voltages $v_a(t)$ and $v_b(t)$ shown in Figure P4.74. Assume:

$$i(t) = 2\cos(300t)\ \text{A}$$
$$v(t) = 7\cos(300t + \pi/4)\ \text{V}$$
$$R_1 = 4\ \Omega \qquad R_2 = 3\ \Omega \qquad R_3 = 5\ \Omega$$
$$L = 300\ \text{mH} \qquad C = 300\ \mu\text{F}$$

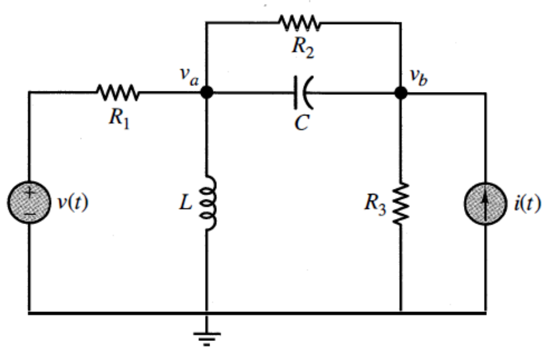

Figure P4.74