2.41 Find $V_1$ in the network in Fig. P2.41.

![Figure P2.41](image)

2.42 Find the power supplied by each source, including the dependent source, in Fig. P2.42.

![Figure P2.42](image)

2.43 Find the power absorbed by the dependent voltage source in the circuit in Fig. P2.43.

![Figure P2.43](image)

2.44 Find the power absorbed by the dependent source in the circuit in Fig. P2.44.

![Figure P2.44](image)

2.45 The 100-V source in the circuit in Fig. P2.45 is supplying 200 W. Solve for $V_2$.

![Figure P2.45](image)

2.46 Find the value of $V_2$ in Fig. P2.46 such that $V_1 = 0$.

![Figure P2.46](image)

2.47 Find $I_o$ in the network in Fig. P2.47.

![Figure P2.47](image)

2.48 Find $I_o$ in the network in Fig. P2.48.

![Figure P2.48](image)

2.49 Find the power supplied by each source in the circuit in Fig. P2.49.

![Figure P2.49](image)
2.62 Find $R_{AB}$ in the network in Fig. P2.62.

2.63 Find the equivalent resistance $R_{eq}$ in the network in Fig. P2.63.

2.59 Find $R_{AB}$ in the circuit in Fig. P2.59.

2.60 Find $R_{AB}$ in the network in Fig. P2.60.
3.25 Use nodal analysis to solve for the node voltages in the circuit in Fig. P3.25. Also calculate the power supplied by the 2 mA current source.

3.26 Use nodal analysis to determine the node voltages defined in the circuit in Fig. P3.26.

3.22 Find $V_o$ in the network in Fig. P3.22 using nodal analysis.

3.23 Find $I_o$ in the circuit in Fig. P3.23 using nodal analysis.
3.69 Use loop analysis to find $V_o$ in the circuit in Fig. P3.69.

3.70 Using loop analysis, find $V_o$ in the network in Fig. P3.70.

3.71 Find $I_o$ in the circuit in Fig. P3.71.

3.65 Find $V_o$ in the network in Fig. P3.65 using loop analysis.

3.66 Find $V_o$ in the circuit in Fig. P3.66 using loop analysis.

3.67 Find $I_o$ in the network in Fig. P3.67 using loop analysis.
3.105 Use both nodal and loop analyses to find \( V_o \) in the circuit in Fig. P3.105.

3.106 Find \( I_o \) in the network in Fig. P3.106 using nodal analysis.

3.103 Use mesh analysis to find the power delivered by the current-control voltage source in the circuit in Fig. P3.103.
Use superposition to find $I_o$ in the circuit in Fig. P.5.21.

Use superposition to find $I_o$ in the network in Fig. P.5.22.

Use superposition to find $V_o$ in the circuit in Fig. P.5.23.

Use superposition to find $I_o$ in the circuit in Fig. P.5.17.

Use superposition to find $I_o$ in the network in Fig. P.5.18.

Use superposition to find $V_o$ in the circuit in Fig. P.5.19.
5.36 Find $I_o$ in the network in Fig. P5.36 using Thévenin's theorem.

5.37 Find $I_o$ in the network in Fig. P5.37 using Thévenin's theorem.

5.38 Find $V_o$ in the circuit in Fig. P5.38 using Thévenin's theorem.

5.39 Find $V_o$ in the circuit in Fig. P5.39 using Thévenin's theorem.

5.33 Use Thévenin's theorem to find $I_o$ in the circuit using Fig. P5.33.

5.34 Use Thévenin's theorem to find $V_o$ in the circuit using Fig. P5.34.

5.35 Use Thévenin's theorem to find $V_o$ in the circuit in Fig. P5.35.

5.39 Use superposition to find $I_o$ in the network in Fig. P5.39.

5.30 Use superposition to find $I_o$ in the circuit in Fig. P5.30.

5.31 Use superposition to find $I_o$ in the circuit in Fig. P5.31.
5.91 Find $I_o$ in the circuit in Fig. P5.91 using source transformation.

![Figure P5.91](image)

5.92 Use source exchange to find $I_o$ in the network in Fig. P5.92.

![Figure P5.92](image)

5.93 Use a combination of $Y - \Delta$ transformation source transformation to find $I_o$ in the circuit in Fig. P5.93.

![Figure P5.93](image)

5.94 Find $V_o$ in the network in Fig. P5.94 using source exchange.

![Figure P5.94](image)

5.95 Use source exchange to find $I_o$ in the circuit in Fig. P5.95.

![Figure P5.95](image)

5.96 Use source exchange to find $I_o$ in the network in Fig. P5.96.

![Figure P5.96](image)
6.42 The inductor in Fig. P6.42a is 4.7 \mu H with a tolerance of 20%. Given the current waveform in Fig. 6.42b, graph the voltage \( v(t) \) for the minimum and maximum inductor values.

![Figure P6.42](image)

6.43 If the total energy stored in the circuit in Fig. P6.43 is 80 mJ, what is the value of \( L \)?

![Figure P6.43](image)

6.44 Find the value of \( C \) if the energy stored in the capacitor in Fig. P6.44 equals the energy stored in the inductor.

![Figure P6.44](image)

6.45 Given the network in Fig. P6.45, find the power dissipated in the 3-\( \Omega \) resistor and the energy stored in the capacitor.

![Figure P6.45](image)

6.46 Calculate the energy stored in the inductor in the circuit shown in Fig. P6.46.

![Figure P6.46](image)

6.47 Calculate the energy stored in both the inductor and the capacitor shown in Fig. P6.47.

![Figure P6.47](image)

6.48 Given a 1-, 3-, and 4-\( \mu F \) capacitor, can they be interconnected to obtain an equivalent 2-\( \mu F \) capacitor?

6.49 Find the total capacitance \( C_T \) of the network in Fig. P6.49.

![Figure P6.49](image)

6.50 Find the total capacitance \( C_T \) of the network in Fig. P6.50.

![Figure P6.50](image)

6.51 Find \( C_T \) in the network shown in Fig. P6.51.

![Figure P6.51](image)

6.52 Find \( C_T \) in the circuit in Fig. P6.52.

![Figure P6.52](image)

6.53 Determine the value of \( C_T \) in the circuit in Fig. P6.53.

![Figure P6.53](image)
7.28 Find \( i_0(t) \) for \( t > 0 \) in the circuit in Fig. P7.28.

7.29 Find \( i_0(t) \) for \( t > 0 \) in the circuit in Fig. P7.29.

7.30 Find \( i_0(t) \) for \( t > 0 \) in the network in Fig. P7.30.

7.31 Find \( i_0(t) \) for \( t > 0 \) in the circuit in Fig. P7.31.

7.32 Use the step-by-step method to find \( v_o(t) \) for \( t > 0 \) in the network in Fig. P7.32.

7.33 Find \( v_o(t) \) for \( t > 0 \) in the network in Fig. P7.33 using the step-by-step method.

7.34 Find \( v_o(t) \) for \( t > 0 \) in the network in Fig. P7.34 using the step-by-step method.
7.58 Find \( i_o(t) \) for \( t > 0 \) in the network in Fig. P7.58.

```
\begin{circuit}\[\begin{array}{c}
\text{3 kΩ} \\
\text{1 kΩ} \\
\text{4 kΩ} \\
\text{150 µF} \\
\text{2 kΩ} \\
\text{6 V} \\
\text{\( i_o(t) \)}
\end{array}\end{circuit}
```

Figure P7.58

7.59 Find \( v_c(t) \) for \( t > 0 \) in the circuit in Fig. P7.59 using the step-by-step method.

```
\begin{circuit}\[\begin{array}{c}
\text{5 Ω} \\
\text{5 Ω} \\
\text{20 Ω} \\
\text{0.5 F} \\
\text{10 Ω} \\
\text{10 Ω} \\
\text{6 A} \\
\text{\( v_c(t) \)} \\
\end{array}\end{circuit}
```

Figure P7.59

7.60 Find \( i(t) \) for \( t > 0 \) in the circuit in Fig. P7.60 using the step-by-step method.

```
\begin{circuit}\[\begin{array}{c}
\text{5 Ω} \\
\text{2 Ω} \\
\text{2 Ω} \\
\text{30 V} \\
\text{\( i(t) \)} \\
\end{array}\end{circuit}
```

Figure P7.60

7.61 Find \( i(t) \) for \( t > 0 \) in the circuit in Fig. P7.61 using the step-by-step method.

```
\begin{circuit}\[\begin{array}{c}
\text{12 Ω} \\
\text{10 Ω} \\
\text{15 Ω} \\
\text{\( i(t) \)} \\
\text{6 Ω} \\
\text{\( 1 H \)} \\
\text{6 Ω}
\end{array}\end{circuit}
```

Figure P7.61

7.62 Find \( v_o(t) \) for \( t > 0 \) in the circuit in Fig. P7.62.

```
\begin{circuit}\[\begin{array}{c}
\text{6 V} \\
\text{1 kΩ} \\
\text{4 mA} \\
\text{\( v_o(t) \)}
\end{array}\end{circuit}
```

Figure P7.62

7.63 Find \( i_o(t) \) for \( t > 0 \) in the network in Fig. P7.63.

```
\begin{circuit}\[\begin{array}{c}
\text{12 V} \\
\text{6 Ω} \\
\text{3 Ω} \\
\text{0.2 H} \\
\text{\( i_o(t) \)} \\
\text{\( t = 0 \)}
\end{array}\end{circuit}
```

Figure P7.63

7.64 Find \( v_o(t) \) for \( t > 0 \) in the circuit in Fig. P7.64.

```
\begin{circuit}\[\begin{array}{c}
\text{6 Ω} \\
\text{6 Ω} \\
\text{0.1 H} \\
\text{6 Ω} \\
\text{\( v_o(t) \)} \\
\text{\( t = 0 \)}
\end{array}\end{circuit}
```

Figure P7.64

7.65 Find \( i_o(t) \) for \( t > 0 \) in the circuit in Fig. P7.65.

```
\begin{circuit}\[\begin{array}{c}
\text{12 V} \\
\text{6 Ω} \\
\text{6 Ω} \\
\text{4 Ω} \\
\text{2 Ω} \\
\text{\( i_o(t) \)} \\
\text{\( t = 0 \)}
\end{array}\end{circuit}
```

Figure P7.65
8.45 If $V_i = 4\, /0^\circ$ V, find $I_o$ in Fig. P8.45.

8.46 Find $V_S$ in the network in Fig. P8.46, if $V_i = 4\, /0^\circ$ V.

8.47 In the network in Fig. P8.47, $V_o$ is known to be $4\, /45^\circ$ V. Find $Z$.

8.48 In the network in Fig. P8.48, $V_o = 4\, /0^\circ$ A. Find $I_x$.

8.49 If $I_o = 4\, /0^\circ$ A in the circuit in Fig. P8.49, find $I_v$.

8.50 If $I_o = 4\, /0^\circ$ A in the network in Fig. P8.50, find $I_v$.

8.51 Using nodal analysis, find $I_o$ in the circuit in Fig. P8.51.

8.52 Use nodal analysis to find $I_o$ in the circuit in Fig. P8.52.
8.37 The network in Fig. P8.137 operates at \( f = 60 \) Hz. Find the voltage \( V_o \).

8.38 Find \( I_1 \) in the network in Fig. P8.138.

8.39 Find \( I_x \) in the network in Fig. P8.139.

8.43 Find \( V_y \) in the network in Fig. P8.133.

8.34 Use both nodal analysis and loop analysis to find \( I_0 \) in the network in Fig. P8.134.

8.44 Given the circuit in Fig. P8.135, at what frequency are the magnitudes of \( V_1(t) \) and \( i_L(t) \) equal?
12.52 The source in the network in Fig. P12.52 is \( i_s(t) = \cos 1000t + \cos 1500t \) A. \( R = 200 \ \Omega \) and \( C = 500 \ \mu F \). If \( \omega_0 = 1000 \) rad/s, find \( L, Q, \) and the BW. Compute the output voltage \( v_o(t) \) and discuss the magnitude of the output voltage at the two input frequencies.

![Figure P12.52](image)

12.53 Consider the network in Fig. P12.53. If \( R = 1 \) k\( \Omega \), \( L = 20 \) mH, \( C = 50 \) \( \mu F \), and \( R_s = \infty \), determine the resonant frequency \( \omega_0 \) the \( Q \) of the network, and the bandwidth of the network. What impact does an \( R_s \) of 10 k\( \Omega \) have on the quantities determined?

![Figure P12.53](image)

12.54 Determine the value of \( C \) in the network shown in Fig. P12.54 for the circuit to be in resonance.

![Figure P12.54](image)

12.55 Determine the equation for the nonzero resonant frequency of the impedance shown in Fig. P12.55.

![Figure P12.55](image)

12.56 Determine the new parameters of the network in Fig. P12.56 if \( \omega_{\text{new}} = 10^4 \omega_{\text{old}} \).

![Figure P12.56](image)

12.57 Determine the new parameters of the network shown in Fig. P12.57 if \( Z_{\text{new}} = 10^4 Z_{\text{old}} \).

![Figure P12.57](image)
12.26 Sketch the magnitude characteristic of the Bode plot for the transfer function

\[ H(j\omega) = \frac{+6.4(j\omega)}{(j\omega + 1)(-\omega^2 + 8j\omega + 64)} \]

12.27 Find \( H(j\omega) \) if its magnitude characteristic is shown in Fig. P12.27.

![Figure P12.27](image)

12.28 Determine \( H(j\omega) \) from the magnitude characteristic shown in Fig. P12.28.

![Figure P12.28](image)

12.29 Determine \( H(j\omega) \) from the magnitude characteristic of the Bode plot shown in Fig. P12.29.

![Figure P12.29](image)

12.30 Determine \( H(j\omega) \) from the magnitude characteristic of the Bode plot shown in Fig. P12.30.

![Figure P12.30](image)

12.31 The magnitude characteristic of a band-elimination filter is shown in Fig. P12.31. Determine \( H(j\omega) \).

![Figure P12.31](image)

12.32 Given the magnitude characteristic in Fig. P12.32, find \( H(j\omega) \).

![Figure P12.32](image)

12.33 Find \( H(j\omega) \) if its magnitude characteristic is shown in Fig. P12.33.

![Figure P12.33](image)
13.54 The switch in the circuit in Fig. P13.54 opens at $t = 0$. Find $i(t)$ for $t > 0$ using Laplace transforms.

![Figure P13.54](image)

13.58 The switch in the circuit in Fig. P13.58 has been closed for a long time and is opened at $t = 0$. Find $i(t)$ for $t > 0$ using Laplace transforms.

![Figure P13.58](image)

13.55 The switch in the circuit in Fig. P13.55 has been closed for a long time and is opened at $t = 0$. Find $i(t)$ for $t > 0$ using Laplace transforms.

![Figure P13.55](image)

13.59 The switch in the circuit in Fig. P13.59 has been closed for a long time and is opened at $t = 0$. Find $i(t)$ for $t > 0$ using Laplace transforms.

![Figure P13.59](image)

13.56 In the network in Fig. P13.56, the switch opens at $t = 0$. Use Laplace transforms to find $i_L(t)$ for $t > 0$.

![Figure P13.56](image)

13.57 The switch in the circuit in Fig. P13.57 has been closed for a long time and is opened at $t = 0$. Find $i(t)$ for $t > 0$, using Laplace transforms.

![Figure P13.57](image)

13.60 In the circuit shown in Fig. P13.60, switch action occurs at $t = 0$. Determine the voltage $v_o(t)$, $t > 0$ using Laplace transforms.

![Figure P13.60](image)
Given the following functions \( F(s) \), find \( f(t) \).

(a) \( F(s) = \frac{s + 6}{(s + 3)(s^2 + 6s + 18)} \)
(b) \( F(s) = \frac{s + 4}{(s + 4)(s + 8)} \)
(c) \( F(s) = \frac{s^2}{(s + 2)^2} + 2s + 2 \)

Given the following functions \( F(s) \), find \( f(t) \).

(a) \( F(s) = \frac{s + 1}{(s + 2)(s^2 + 2s + 2)} \)
(b) \( F(s) = \frac{s}{s^2 + 4s + 5} \)

Find the inverse Laplace transform of the following functions.

(a) \( F(s) = \frac{e^{-s}}{s + 1} \)
(b) \( F(s) = \frac{1 - e^{-2s}}{s} \)
(c) \( F(s) = \frac{1 - e^{-s}}{s + 2} \)

Find \( f(t) \) if \( F(s) \) is given by the following functions:

(a) \( F(s) = \frac{2(s + 1)e^{-s}}{(s + 2)(s + 4)} \)
(b) \( F(s) = \frac{10(s + 2)e^{-2s}}{(s + 1)(s + 4)} \)
(c) \( F(s) = \frac{se^{-s}}{(s + 4)(s + 8)} \)

Find the inverse Laplace transform of the following functions.

(a) \( F(s) = \frac{(s + 2)e^{-s}}{s(s + 2)} \)
(b) \( F(s) = \frac{e^{-10s}}{(s + 2)(s + 3)} \)
(c) \( F(s) = \frac{(s^2 + 2s + 1)e^{-2s}}{s(s + 1)(s + 2)} \)
(d) \( F(s) = \frac{(s + 1)e^{-4s}}{s^2(s + 2)} \)

Find \( f(t) \) if \( F(s) \) is given by the following function:

\( F(s) = \frac{s + 1}{s(s + 2)(s^2 + 2s + 2)} \)

Find the inverse Laplace transform of the function

\( F(s) = \frac{10s(s + 2)e^{-4s}}{(s + 1)^2(s^2 + 2s + 2)} \)

Find \( f(t) \) if \( F(s) \) is given by the expression

\( F(s) = \frac{s^2e^{-2s}}{(s^2 + 1)(s + 1)(s^2 + 2s - 2)} \)

Solve the following differential equations using Laplace transforms.

(a) \( \frac{dx(t)}{dt} + 4x(t) = e^{-2t}, \ x(0) = 1 \)
(b) \( \frac{dx(t)}{dt} + 6x(t) = 4u(t), \ x(0) = 2 \)

Solve the following differential equations using Laplace transforms.

(a) \( \frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = e^{-2t}, \ y(0) = y'(0) = 0 \)
(b) \( \frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 4y(t) = u(t), \ y(0) = 0, \ y'(0) = 1 \)

Solve the following integrodifferential equation using Laplace transforms.

\( \frac{dy(t)}{dt} + 2y(t) + \int_0^t y(\lambda)d\lambda = 1 - e^{-2t}, \ y(0) = 0, \ t > 0 \)

Use Laplace transforms to find \( y(t) \) if

\( \frac{dy(t)}{dt} + 3y(t) + 2\int_0^t y(x)dx = u(t), \ y(0) = 0, \ t > 0 \)

Use Laplace transforms to solve the following integrodifferential equation.

\( \frac{dy(t)}{dt} + 2y(t) + \int_0^t y(\lambda)e^{-2(t-x)}d\lambda = 4u(t), \ y(0) = 1, \ t > 0 \)

Find \( f(t) \) using convolution if \( F(s) \) is

\( F(s) = \frac{1}{(s + 1)(s + 2)} \)

Use convolution if \( f(t) \) if

\( F(s) = \frac{1}{(s + 1)(s + 2)^2} \)
14.20 Use superposition to find $v_o(t), t > 0$, in the network shown in Fig. P14.20.

Figure P14.20

14.21 Use superposition to find $v_o(t), t > 0$, in the network in Fig. P14.21.

Figure P14.21

14.22 Use superposition to find $v_o(t), t > 0$, in the network in Fig. P14.22.

Figure P14.22

14.23 Use source transformation to find $v_o(t), t > 0$, in the circuit in Fig. P14.23.

Figure P14.23


14.25 Use Thévenin’s theorem to find $v_o(t), t > 0$, in Fig. P14.25.

Figure P14.25

14.26 Use Thévenin’s theorem to find $v_o(t), t > 0$, in Fig. P14.26.

Figure P14.26

14.27 Use Thévenin’s theorem to find $i_o(t), t > 0$, in Fig. P14.27.

Figure P14.27

14.28 Use Thévenin’s theorem to find $i_o(t), t > 0$, in Fig. P14.28.

Figure P14.28

14.29 Use Thévenin’s theorem to determine $i_o(t), t > 0$, in the circuit shown in Fig. P14.29.

Figure P14.29
14.12 For the network shown in Fig. P14.12, find $v_o(t), t > 0$, using loop equations.

\[ \begin{align*} &4u(t) \text{ V} \quad 2u(t) \text{ A} \quad \frac{1}{2} \text{ F} \\ &1 \Omega \quad 1 \Omega \quad v_o(t) \end{align*} \]

Figure P14.12

14.13 For the network shown in Fig. P14.13, find $v_o(t), t > 0$, using mesh equations.

\[ \begin{align*} 2u(t) \text{ A} & \quad \frac{1}{2} \text{ F} \quad 1 \Omega \quad 2 \Omega \\ &1 \Omega \quad 1 \Omega \quad v_o(t) \end{align*} \]

Figure P14.13

14.14 Use loop equations to find $i_o(t), t > 0$, in the network shown in Fig. P14.14.

\[ \begin{align*} 2u(t) \text{ A} & \quad \frac{1}{2} \text{ F} \quad 1 \Omega \quad 1 \Omega \\ &2 \Omega \quad e^{-t}u(t) \text{ A} \end{align*} \]

Figure P14.14

14.15 Given the network in Fig. P14.15, find $i_o(t), t > 0$, using mesh equations.

\[ \begin{align*} 4u(t) \text{ V} & \quad 1 \Omega \quad 2 \Omega \quad 2 \Omega \\ &1 \Omega \quad v_o(t) \end{align*} \]

Figure P14.15

14.16 Use mesh analysis to find $v_o(t), t > 0$, in the network shown in Fig. P14.16.

\[ \begin{align*} \frac{i_x(t)}{2} & \quad 4u(t) \text{ A} \quad 1 \Omega \quad 1 \Omega \\ &1 \Omega \quad v_o(t) \end{align*} \]

Figure P14.16

14.17 Use loop analysis to find $v_o(t)$ for $t > 0$ in the network shown in Fig. P14.17.

\[ \begin{align*} 4e^{-t}u(t) \text{ A} & \quad 1 \Omega \quad 1 \Omega \quad 1 \Omega \\ &2u(t) \text{ A} \quad v_o(t) \end{align*} \]

Figure P14.17

14.18 Use mesh analysis to find $v_o(t)$, for $t > 0$ in the network in Fig. P14.18.

\[ \begin{align*} \frac{1}{2} \text{ F} & \quad e^{-2t}u(t) \text{ V} \quad 1 \Omega \\ &1 \Omega \quad 2u(t) \text{ V} \quad v_o(t) \end{align*} \]

Figure P14.18

14.19 Use mesh analysis to find $v_o(t)$, for $t > 0$ in the network in Fig. P14.19.

\[ \begin{align*} 2v_1(t) \text{ V} & \quad 1 \Omega \quad 4u(t) \text{ V} \\ &2 \Omega \quad 1 \Omega \quad v_o(t) \end{align*} \]

Figure P14.19