### Chapter-2 Basic Laws

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2.45 Find the equivalent resistance at terminals a-b of each circuit in Fig. 2.109.

2.47 Find the equivalent resistance $R_{ab}$ in the circuit of Fig. 2.111.

2.53 Obtain the equivalent resistance $R_{ab}$ in each of the circuits of Fig. 2.117. In (b), all resistors have a value of 30$\Omega$.
2.55 Calculate $I_O$ in the circuit of Fig. 2.119.

![Figure 2.119](image1)

2.57 Find $R_{eq}$ and $I$ in the circuit of Fig. 2.121.

![Figure 2.119](image2)
### Chapter-3  Methods of Analysis

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3.27 Use nodal analysis to determine voltage $v_1$, $v_2$, and $v_3$ in the circuit of Fig. 3.76.

[Figure 3.76]

3.31 Find the node voltage for the circuit in Fig. 3.80.

[Figure 3.80]

3.39 Determine the mesh current $i_1$ and $i_2$ in the circuit shown in Fig. 3.85.

[Figure 3.85]

3.41 Apply mesh analysis to find $i$ in Fig. 3.87.

[Figure 3.87]

3.45 Find current $i$ in the circuit of Fig. 3.91.

[Figure 3.91]
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3.69 For the circuit shown in Fig. 3.113, write the node-voltage equations by inspection.

![Figure 3.113](image)

3.71 Write the mesh-current equations for the circuit in Fig. 3.115. Next, determine the values of $i_1$, $i_2$, and $i_3$.

![Figure 3.115](image)

3.87 For the circuit in Fig. 3.123, find the gain $v_o/v_s$.

![Figure 3.123](image)

3.91 For the transistor circuit of Fig. 3.127, find $I_B$, $V_{CE}$, and $v_o$. Take $\beta=200$, $V_{BE}=0.7V$.

![Figure 3.127](image)
4.10 For the circuit below, find the terminal voltage $V_{ab}$ using superposition.

4.11 Use the superposition principle to find $i_o$ and $v_o$ in the circuit.

4.14 Apply the superposition principle to find $v_o$ in the circuit.

4.18 Use superposition to find $V_o$ below the circuit.
4.22 Referring to below the circuit, use source transformation to determine the current and power in the 8-Ω resistor.

4.24 Use source transformation to find the voltage $V_x$ below the circuit.

4.32 Use source transformation to find $i_x$ below the circuit.

4.38 Apply Thévenin's theorem to find $V_o$ below the circuit.
4.43 Find the Thevenin equivalent looking into terminals a-b below the circuit and solve for $i_x$.

![Circuit Diagram](image1)

4.44 Below the circuit, obtain the Thevenin equivalent as seen from terminals.

![Circuit Diagram](image2)

4.47 Obtain the Thévenin and Norton equivalent circuits below the circuit with respect to terminals a and b.

![Circuit Diagram](image3)

4.51 Below the circuit, obtain the Norton equivalent as viewed from terminals (a) a-b (b) c-d.

![Circuit Diagram](image4)
4.57 Obtain the Thevenin and Norton equivalent circuits at the terminals a-b below the circuit.

![Circuit 1](image1.png)

4.59 Determine the Thevenin and Norton equivalents at terminals a-b below the circuit.

![Circuit 2](image2.png)

4.67 The variable resistor R below the circuit is adjusted until it absorbs the maximum power from the circuit. (a) Calculate the value of R for maximum power. (b) Determine the maximum power absorbed by R.

![Circuit 3](image3.png)

4.70 Determine the maximum power delivered to the variable resistor R shown below the circuit.

![Circuit 4](image4.png)
4.75 Below the circuit, determine the value of $R$ such that the maximum power delivered to the load is 3 mW.
5.8  Obtain $v_o$ for each of below the op amp circuits.

5.11  Find $v_o$ and $i_o$ below the circuit.

5.13  Find $v_o$ and $i_o$ below the circuit.
5.19  Determine $i_o$ below the circuit.

5.26  Determine $i_o$ below the circuit.

5.28  Find $i_o$ below the op amp circuit.

5.31  Below the circuit, find $i_v$. 
5.34 Below the op amp circuit, express \( v_o \) in terms of \( v_1 \) and \( v_2 \).
5.57 Find $v_o$ below the op amp circuit.

![Op Amp Circuit](image1.png)

5.61 Determine $v_o$ below the circuit.

![Circuit](image2.png)

5.62 Obtain the closed-loop voltage gain $v_o/v_i$ below the circuit in.

![Circuit](image3.png)
5.71 Determine $v_o$ below the op amp circuit.
Ch. 6 Capacitors and inductors

6.6 The voltage waveform in below circuit is applied across a 30-μF capacitor. Draw the current waveform through it.

6.13 Find the voltage across the capacitors below the circuit under dc conditions.

6.17 Determine the equivalent capacitance for each of the circuits below.
6.18  Find \( C_{eq} \) below the circuit if all capacitors are 4 \( \mu F \).

\[ \text{Diagram with} \quad C_{eq} \]

6.22  Obtain the equivalent capacitance below the circuit.

\[ \text{Diagram with capacitances} \]

6.26  Three capacitors, \( C_1 = 5 \mu F \), \( C_2 = 10 \mu F \), and \( C_3 = 20 \mu F \), are connected in parallel across a 150-V source. Determine:

(a) the total capacitance,

(b) the charge on each capacitor,

(c) the total energy stored in the parallel combination.
6.28 Obtain the equivalent capacitance of below the network.

6.31 If \( v(0) = 0 \), find \( v(t) \), \( i_1(t) \), and \( i_2(t) \) below the circuit.

6.32 Below the circuit, let \( i_s = 30e^{-2t} \) mA and \( v_1(0) = 50 \) V, \( v_2(0) = 20 \) V. Determine: (a) \( v_1(t) \) and \( v_2(t) \), (b) the energy in each capacitor at \( t = 0.5 \) s.
6.46  Find $v_C$, $i_L$, and the energy stored in the capacitor and inductor below the circuit under dc conditions.

![Circuit Diagram](image)

6.48  Under steady-state dc conditions, find $i$ and $v$ below the circuit.

![Circuit Diagram](image)

6.53  Find $L_{eq}$ at the terminals below the circuit.

![Circuit Diagram](image)
6.55 Find $L_{eq}$ in each of below the circuits.

![Image of circuits](image)

6.61 Consider below the circuit. Find: (a) $L_{eq}$, $i_1(t)$ and $i_2(t)$ if $i_x = 3e^{-t}$ mA

(b) $v_o(t)$, (c) energy stored in the 20-mH inductor at $t=1$s.

![Image of circuit](image)

6.74 The triangular waveform in below Fig. (a) is applied to the input of the op amp differentiator in Fig. (b). Plot the output.

![Image of waveform and circuit](image)
7.2 Find the time constant for the\( RC \) circuit in the figure below.

![Circuit Diagram](image1)

7.5 For the circuit shown in the figure below, find \( i(t), t > 0 \). 

![Circuit Diagram](image2)

7.8 For the circuit in the figure below, if \( v = 10e^{-4t} \) V and \( i = 0.2e^{-4t} \) A, \( t > 0 \)

(a) Find \( R \) and \( C \).
(b) Determine the time constant.
(c) Calculate the initial energy in the capacitor.
(d) Obtain the time it takes to dissipate 50 percent of the initial energy.

![Circuit Diagram](image3)
7.12 The switch in the circuit of the figure below has been closed for a long time. At \( t = 0 \) the switches opened. Calculate \( i(t) \) for \( t > 0 \).

![Circuit Diagram](image)

7.18 For the circuit in the figure below, determine \( v_0(t) \) when \( i(0) = 1 \) A and \( v(t) = 0 \).

![Circuit Diagram](image)

7.22 Find \( i(t) \) and \( v(t) \) for \( t > 0 \) in the circuit of the figure below if \( i(0) = 10 \) A.

![Circuit Diagram](image)
7.42 (a) If the switch in the figure below has been open for a long time and is closed at \( t = 0 \), find \( v_o(t) \).

(b) Suppose that the switch has been closed for a long time and is opened at \( t = 0 \). Find \( v_o(t) \).

\[ \begin{align*}
12 \text{ V} & \quad 2 \Omega \\
\text{+} & \quad t = 0 \\
4 \Omega & \quad 3 \text{ F} \\
& \quad + \\
& \quad - \quad v_o
\end{align*} \]

7.48 Find \( v(t) \) and \( i(t) \) in the circuit of the figure below.

\[ \begin{align*}
\text{u(-t) A} & \quad 10 \Omega \\
& \quad 0.1 \text{ F} \\
20 \Omega & \quad + \\
& \quad - \quad i \\
& \quad + \\
& \quad - \quad v
\end{align*} \]

7.54 Obtain the inductor current for both \( t < 0 \) and \( t > 0 \) in each of the circuits in the figure below.

(a) \[ \begin{align*}
2 \text{ A} & \quad 4 \Omega \\
& \quad 12 \Omega \\
& \quad t = 0 \\
4 \Omega & \quad 4 \Omega \\
& \quad 3.5 \text{ H} \\
i & \quad i
\end{align*} \]

(b) \[ \begin{align*}
10 \text{ V} & \quad 24 \text{ V} \\
& \quad 2 \Omega \\
& \quad 6 \Omega \\
& \quad 3 \Omega \\
i & \quad i
\end{align*} \]
7.62 For the circuit in the figure below, calculate $i(t)$ if $i(0) = 0$.

[Image of an RC circuit with $u(t-1)\,\text{V}$, $3\,\Omega$, $6\,\Omega$, and $2\,\text{H}$]

7.73 For the op amp circuit in Fig. 7.138, let $R_1 = 10\,\text{k}\,\Omega$, $R_f = 20\,\text{k}\,\Omega$, $C = 20\,\mu\text{F}$, and $v(0) = 1\,\text{V}$. Find $v_0$.

[Image of an op amp circuit with $R_1$, $C$, and $R_f$]

7.78 The switch in Fig. 7.142 moves from position $a$ to $b$ at $t = 0$. Use PSpice to find $i(t)$ for $t > 0$.

[Image of a circuit with a 108 V source, $3\,\Omega$, $6\,\Omega$, $4\,\Omega$, $6\,\Omega$, and $2\,\text{H}$]
Ch. 8  Second-Order Circuits

8.4  In the circuit of the figure below, find:
(a) \( v(0^+) \) and \( i(0^+) \),
(b) \( dv(0^+)/dt \) and \( di(0^+)/dt \),
(c) \( v(\infty) \) and \( i(\infty) \).

8.5  Refer to the circuit in the figure below. Determine:
(a) \( v(0^+) \) and \( i(0^+) \),
(b) \( dv(0^+)/dt \) and \( di(0^+)/dt \),
(c) \( v(\infty) \) and \( i(\infty) \).

8.16  Find \( i(t) \) for \( t > 0 \) in the circuit of the figure below.
8.25 In the circuit of the figure below, calculate $i_0(t)$ and $v_0(t)$ for $t > 0$.

![Circuit Diagram](image)

8.31 Consider the circuit in the figure below. Find $v_L(0^+)$ and $v_C(0^+)$.

![Circuit Diagram](image)

8.37 For the network in the figure below, solve for $i(t)$ for $t > 0$.

![Circuit Diagram](image)
8.42 Given the network in the figure below, find \( v(t) \) for \( t > 0 \).

8.47 Find the output voltage \( v_0(t) \) in the circuit of the figure below.

8.57 If the switch in the figure below has been closed for a long time before \( t = 0 \), but is opened at \( t = 0 \) determine:
(a) the characteristic equation of the circuit,
(b) \( i_x \) and \( v_R \) for \( t > 0 \).
8.62 Find the response $v_R(t)$ for $t > 0$ in the circuit of the figure below. Let $R = 3\Omega$, $L = 2\, \text{H}$, $C = 1/18\, \text{F}$.

\begin{center}
\includegraphics[width=0.5\textwidth]{circuit1.png}
\end{center}

8.65 Determine the differential equation for the op amp circuit in the figure below. If $v_1(0^+) = 2\, \text{V}$ and $v_2(0^+) = 0\, \text{V}$ find $v_o$ for $t > 0$. Let $R = 100\, \text{k}\Omega$ and $C = 1\, \mu\text{F}$.

\begin{center}
\includegraphics[width=0.5\textwidth]{circuit2.png}
\end{center}

8.67 In the op amp circuit of the figure below, determine $v_o(t)$ for $t > 0$. Let $v_{in} = u(t)\, \text{V}$, $R_1 = R_2 = 10\, \text{k}\Omega$, $C_1 = C_2 = 100\, \mu\text{F}$.

\begin{center}
\includegraphics[width=0.5\textwidth]{circuit3.png}
\end{center}