Elektronik

EITA10 – Elektronik

Pietro Andreani
Institutionen för elektro- och informationsteknik
Lunds universitet

Problem 1.21

***P1.21.** Compute the power for each element shown in Figure P1.21. For each element, state whether energy is being absorbed by the element or supplied by it.

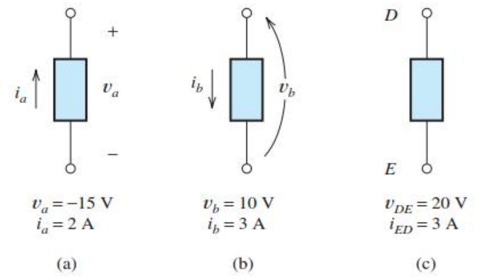

Figure P1.21

Problem 1.32

***P1.32.** Use KCL to find the values of i_a, i_c, and i_d for the circuit of Figure P1.32. Which elements are connected in series in this circuit?

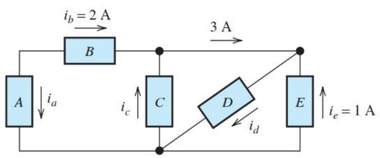

Figure P1.32

Problem 1.35

***P1.35.** Identify elements that are in series in the circuit of Figure P1.31.

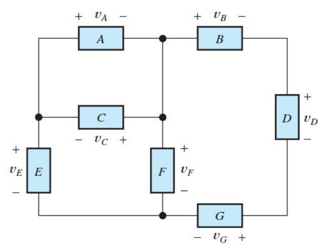

Figure P1.31

Problem 1.37

***P1.37.** Given that $i_a = 2$ A, $i_b = 3$ A, $i_d = -5$ A, and $i_h = 4$ A, determine the values of the other currents in Figure P1.37.

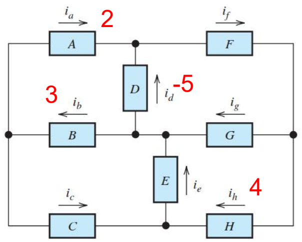

Figure P1.37

eller

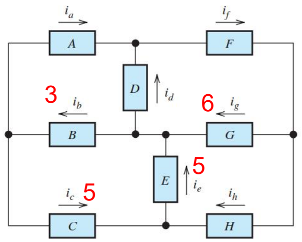

Figure P1.37

Problem 1.42

***P1.42.** Use KVL to solve for the voltages v_a, v_b, and v_c in Figure P1.42.

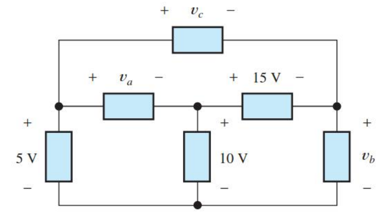

Figure P1.42

Problem 1.71

***P1.71.** What type of controlled source is shown in the circuit of Figure P1.71? Solve for v_s.

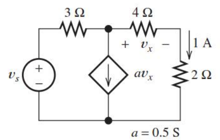

Figure P1.71

Problem 2.1

***P2.1.** Reduce each of the networks shown in Figure P2.1 to a single equivalent resistance by combining resistances in series and parallel.

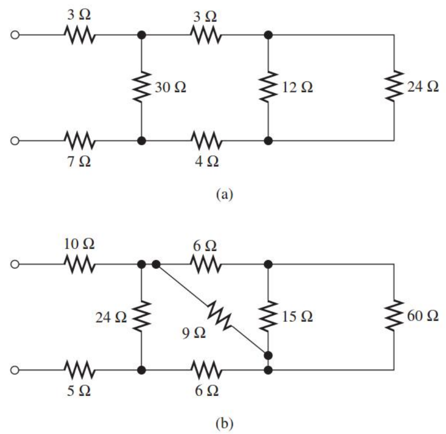

Figure P2.1

Problem 2.24

***P2.24.** Find the values of i_1 and i_2 in Figure P2.24. Find the power for each element in the circuit, and state whether each is absorbing or delivering energy. Verify that the total power absorbed equals the total power delivered.

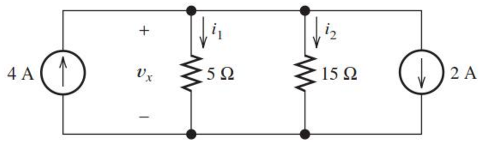

Figure P2.24

eller

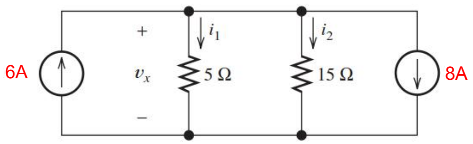

Figure P2.24

Problem 2.36

***P2.36.** Use the voltage-division principle to calculate v_1, v_2, and v_3 in Figure P2.36.

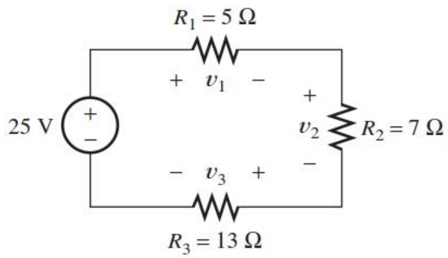

Figure P2.36

Problem 2.37

***P2.37.** Use the current-division principle to calculate i_1 and i_2 in Figure P2.37.

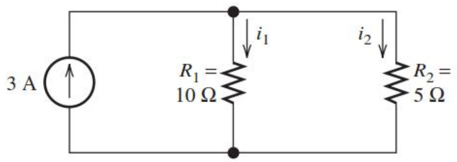

Figure P2.37

Problem 2.49

***P2.49.** Write equations and solve for the node voltages shown in Figure P2.49. Then, find the value of i_1.

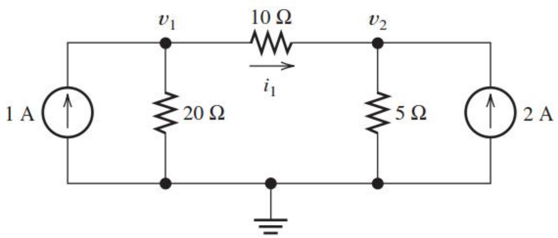

Figure P2.49

Problem 2.53

***P2.53.** Solve for the node voltages shown in Figure P2.53. Then, find the value of i_s.

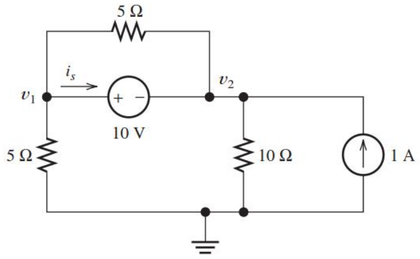

Figure P2.53

Problem 2.83

***P2.83.** Find the Thévenin and Norton equivalent circuits for the two-terminal circuit shown in Figure P2.83.

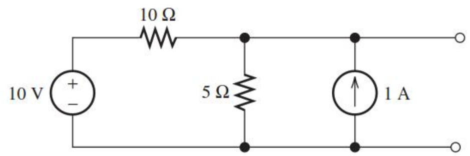

Figure P2.83

Problem 2.97

***P2.97.** Use superposition to find the current i in Figure P2.97. First, zero the current source and find the value i_v caused by the voltage source alone. Then, zero the voltage source and find the value i_c caused by the current source alone. Finally, add the results algebraically.

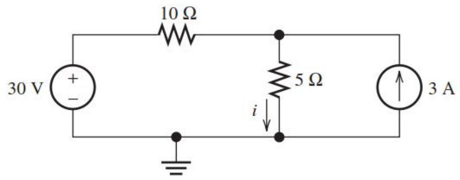

Figure P2.97

Problem 2.98

***P2.98.** Solve for i_s in Figure P2.53 by using superposition.

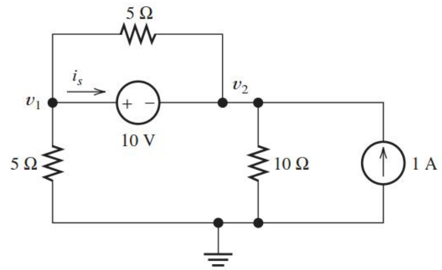

Figure P2.53

Problem 3.6

***P3.6.** A 10000-μF capacitor, initially charged to 10 V, is discharged by a steady current of 100 μA. How long does it take to discharge the capacitor to 0 V?

Problem 3.24

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

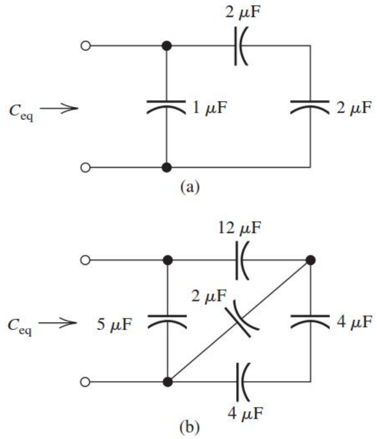

Figure P3.24

Problem 3.45

***P3.45.** A constant voltage of 10 V is applied to a 50-μH inductance, as shown in Figure P3.45. The current in the inductance at $t = 0$ is -100 mA. At what time t_x does the current reach $+100$ mA?

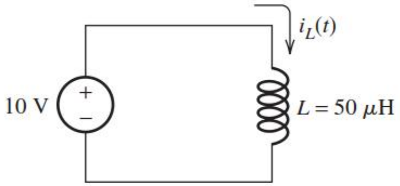

Figure P3.45

Problem 3.60

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

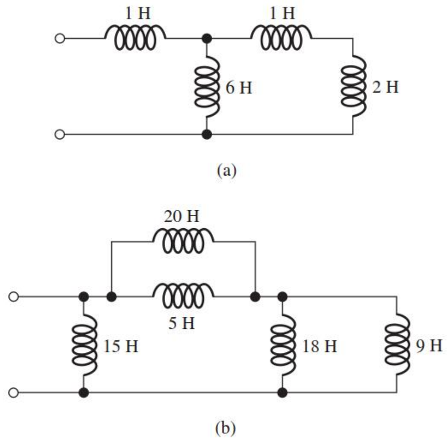

Figure P3.60

Problem 4.3

P4.3. The initial voltage across the capacitor shown in Figure P4.3 is $v_C(0+) = 0$. Find an expression for the voltage across the capacitor as a function of time, and sketch to scale versus time.

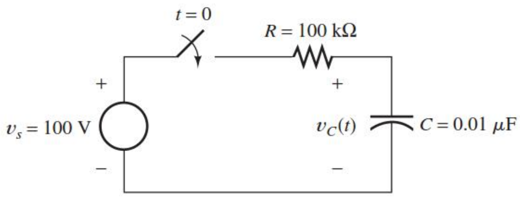

Figure P4.3

Problem 4.4

***P4.4.** Repeat Problem P4.3 for an initial voltage $v_C(0+) = -50$ V.

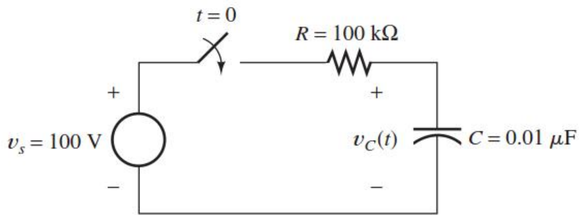

Figure P4.3

Problem 4.16

***P4.16.** At time t_1, a capacitance C is charged to a voltage of V_1. Then, the capacitance discharges through a resistance R. Write an expression for the voltage across the capacitance as a function of time for $t > t_1$ in terms of R, C, V_1, and t_1.

Problem 4.34

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

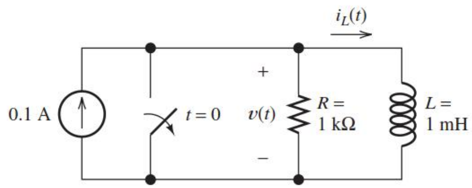

Figure P4.34

Problem 5.4

***P5.4.** A voltage is given by $v(t) = 10\sin(1000\pi t + 30°)$ V. First, use a cosine function to express $v(t)$. Then, find the angular frequency, the frequency in hertz, the phase angle, the period, and the rms value. Find the power that this voltage delivers to a 50-Ω resistance. Find the first value of time after $t = 0$ that $v(t)$ reaches its peak value. Sketch $v(t)$ to scale versus time.

Problem 5.12

***P5.12.** Find the rms value of the current waveform shown in Figure P5.12.

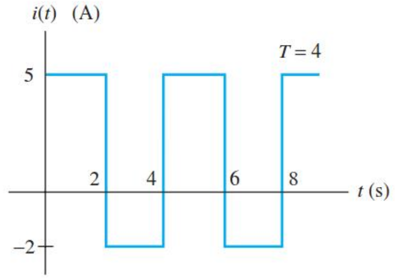

Figure P5.12

Problem 5.38

***P5.38.** Find the phasors for the current and for the voltages of the circuit shown in Figure P5.38. Construct a phasor diagram showing $\mathbf{V}_s$, $\mathbf{I}$, $\mathbf{V}_R$, and $\mathbf{V}_L$. What is the phase relationship between $\mathbf{V}_s$ and $\mathbf{I}$?

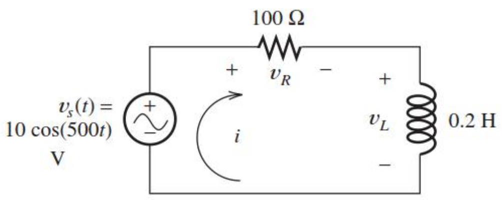

Figure P5.38

Problem 5.40

***P5.40.** Find the phasors for the current and the voltages for the circuit shown in Figure P5.40. Construct a phasor diagram showing $\mathbf{V}_s$, $\mathbf{I}$, $\mathbf{V}_R$, and $\mathbf{V}_C$. What is the phase relationship between $\mathbf{V}_s$ and $\mathbf{I}$?

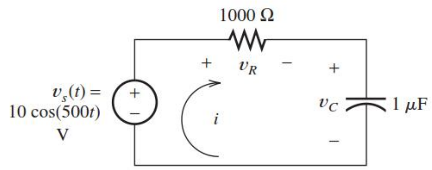

Figure P5.40

Problem 5.42

***P5.42.** Find the complex impedance in polar form of the network shown in Figure P5.42 for $\omega = 500$. Repeat for $\omega = 1000$ and $\omega = 2000$.

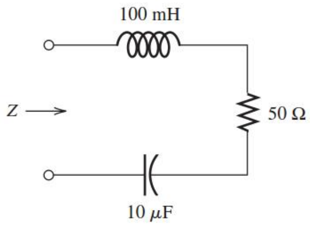

Figure P5.42

Problem 5.52

P5.52. a. At what frequency or frequencies is the series combination of elements shown in Figure P5.52 equivalent to an open circuit? A short circuit? **b.** Repeat with the elements in parallel.

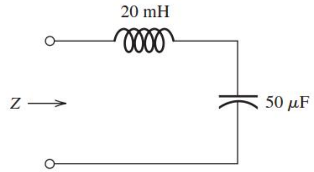

Figure P5.52

Problem 6.21

P6.21. Draw the circuit diagram of a first-order *RC* lowpass filter and give the expression for the half-power frequency in terms of the circuit components. Sketch the magnitude and phase of the transfer function versus frequency.

Problem 6.22

P6.22. Repeat Problem P6.21 for a first-order *RL* lowpass filter.

Problem 6.29

P6.29. The input signal to a filter contains components that range in frequency from 10 Hz to 20 kHz. We wish to reduce the amplitude of the 20-kHz component by a factor of 100 by passing the signal through a first-order lowpass filter. What half-power frequency is required for the filter? By what factor is a component at 2 kHz changed in amplitude in passing through this filter?

Problem 6.50

P6.50. What is a Bode magnitude plot?

Problem 6.53

***P6.53.** A transfer function is given by

$$H(f) = \frac{100}{1 + j(f/1000)}$$

Sketch the asymptotic magnitude and phase Bode plots to scale. What is the value of the half-power frequency?

Problem 6.56

P6.56. Solve for the transfer function $H(f) = \mathbf{V}_{out}/\mathbf{V}_{in}$ and sketch the asymptotic Bode magnitude and phase plots to scale for the circuit shown in Figure P6.56.

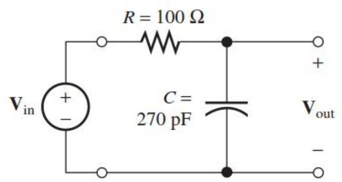

Figure P6.56

Problem 6.57

P6.57. The circuit shown in Figure 6.57 has $R_1 = R_2 = 2\ \text{k}\Omega$ and $C = (1/\pi)\mu\text{F}$. Solve for the transfer function $H(f) = \mathbf{V}_{\text{out}}/\mathbf{V}_{\text{in}}$ and draw the asymptotic Bode magnitude and phase plots.

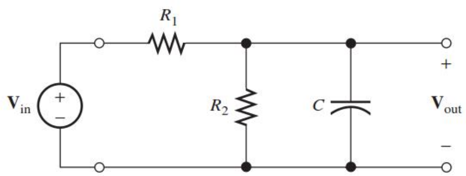

Figure P6.57

Problem 6.63

P6.63. Draw the circuit diagram of a first-order *RC* highpass filter and give the expression for the half-power frequency in terms of the circuit components.

Problem 6.65

***P6.65.** Consider the first-order highpass filter shown in Figure P6.65. The input signal is given by

$$v_{\text{in}}(t) = 5 + 5\cos(2000\pi t)$$

Find an expression for the output $v_{\text{out}}(t)$ in steady-state conditions.

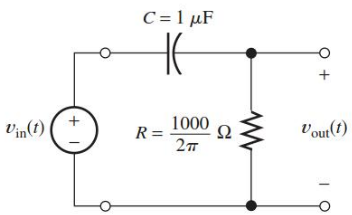

Figure P6.65

Problem 6.68

P6.68. Consider the circuit shown in Figure P6.68. Sketch the Bode magnitude and phase plots to scale for the transfer function $H(f) = \mathbf{V}_{\text{out}}/\mathbf{V}_{\text{in}}$.

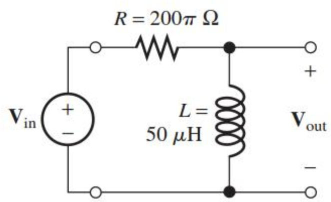

Figure P6.68

Problem 12.6

P12.6. Suppose we have an NMOS transistor that has $V_{to} = 1$ V. What is the region of operation (linear, saturation, or cutoff) if: **a.** $v_{GS} = 0$ V and $v_{DS} = 5$ V; **b.** $v_{GS} = 4$ V and $v_{DS} = 10$ V; **c.** $v_{GS} = 3$ V and $v_{DS} = 1$ V; **d.** $v_{GS} = 3$ V and $v_{DS} = 8$ V?

Problem 12.61

P12.61. Draw the circuit diagram of a CMOS inverter. Draw its equivalent circuit (open and closed switches) if the input is high. Repeat if the input is low.

Problem 12.62

P12.62. Draw the circuit diagram of a two-input CMOS AND gate. (*Hint*: Use a two-input NAND followed by an inverter.)