51. $V_1 = 13{,}45$ V, $Q_1 = 2{,}96$ mC; $V_2 = 6{,}55$ V, $Q_2 = 2{,}16$ mC; $V_3 = 6{,}55$ V, $Q_3 = 0{,}786$ mC
53. 8640 pJ
55. $W_{200\ \mu F} = 9{,}70$ mJ, $W_{100\ \mu F} = 1{,}75$ mJ

Capítulo 11

1. **(a)** 0,04 Wb/m^2 **(b)** 0,04 T **(c)** 88 Ae **(d)** $0{,}4 \times 10^3$ gauss
3. **(a)** 20,06 mH **(b)** taxa de aumento = μ_r
5. **(a)** 42,3 mH **(b)** 1,57 mH **(c)** 75,2 mH **(d)** 1,76 H
7. 6,0 V
9. 14 voltas
11. **(a)** 15 μs
(b) $i_L = 1\text{ mA}\,(1 - e^{-t/15}\ \mu^s)$
(c) $v_L = 20\text{ V}\ e^{-t/15}\ \mu^s$
$v_R = 20\text{ V}\,(1 - e^{-t/15}\ \mu^s)$
(d) i_L : $1\tau = 0{,}632$ mA, $3\tau = 0{,}951$ mA, $5\tau = 0{,}993$ mA; v_L : $1\tau = 7{,}36$ V, $3\tau = 0{,}98$ V, $5 = 140$ mV
13. $R = 1{,}2$ kΩ, $L = 3{,}6$ mH
15. **(a)** $i_L = 9{,}23\text{ mA} - 17{,}23\text{ mA}\ e^{-t/30{,}77}\ \mu^s$, $v_L = 67{,}2\text{ V}\ e^{-t/30{,}77}\ \mu^s$
17. **(a)** $i_L = 2\text{ mA} + 4\text{ mA}\ e^{-t/19{,}23}\ \mu^s$, $v_L = 41{,}6\text{ V}\ e^{-t/19{,}23}\ \mu^s$
19. **(a)** $i_L = 6\text{ mA}\,(1 - e^{-t/0{,}5}\ \mu^s)$, $v_L = 12\text{ V}\ e^{-t/0{,}5}\ \mu^s$
(b) i_L 5,19 mA $e^{-t/83{,}3}\ \mu^s$, $v_L = 62{,}28\text{ V}\ e^{-t/83{,}3\text{ ms}}$
21. **(a)** $i_L = 1{,}3\text{ mA}\,(1 - e^{-t/7{,}56}\ \mu^s)$, $v_L = 8{,}09\text{ V}\ e^{-t/7{,}56}\ \mu^s$
(b) 0,822 mA, 2,98 V
23. **(a)** $i_L = -4{,}54\text{ mA}\,(1 - e^{-t/6{,}67}\ \mu^s)$, $v_L = -6{,}81\text{ V}\ e^{-t/6{,}67\ s}$
(b) $i_L = -3{,}53$ mA, $v_L = 1{,}52$ V
(c) $i_L = -3{,}53\text{ mA}\ e^{-t/2{,}13}\ \mu^s$, $v_L = +16{,}59\text{ V}\ e^{-t/2{,}13}\ \mu^s$
25. **(a)** $i_L = 0{,}68\text{ mA} + 1{,}32\text{ mA}\ e^{-t/0{,}49}$ ms, $v_L = -5{,}43\text{ V}\ e^{-t/0{,}49\text{ ms}}$
27. **(a)** 0,92 μs **(b)** 16,2 V **(c)** 0,81 V
29. **(a)** 4,88 mA **(b)** 99,33 mA **(c)** 13,86 ms
31. **(a)** 13,33 V **(b)** 7,98 μA **(c)** 4,12 μs **(d)** 0,244 V
33. 0 ms–2 ms: 37,5 mV; 2 ms–6 ms: –37,5 mV; 6 ms–9 ms: +25 mV; 9 ms–13 ms: 0 V; 13 ms–14 ms: +25 mV; 14 ms–17 ms: 0 V; 17 ms–19 ms: –12,5 mV
35. 10,75 mH
37. 6,8 mH, 5,7 kΩ, 9,1 kΩ || 2,45 mH
39. 25 mH, 2,2 kΩ, 18 μF
41. **(a)** $i_L = 3{,}56\text{ mA}\,(1 - e^{-t/8{,}31}\ \mu^s)$, $v_L = 4{,}29\text{ V}\ e^{-t/8{,}31}\ \mu^s$
43. $I_1 = 7$ A, $I_2 = 2$ A
45. $V_1 = 12$ V, $I_1 = 3$ A, $V_2 = -8$ V, $I_2 = 0$ A

Capítulo 12

1. Φ : CGS : 5×10^4 maxwells; inglês: 5×10^4 linhas
B: CGS: 8 gauss; inglês : 51,62 linhas/pol.^{2}
3. **(a)** 0,04 T
5. $952{,}4 \times 10^3$ Ae/Wb
7. 2.624,67 Ae/m
9. 2,13 A
11. **(a)** 60 t **(b)** $13{,}34 \times 10^{-4}$ Wb/Am
13. 2,70 A
15. 1,35 N
17. **(a)** 2,02 A **(b)** 2 N
19. 6,12 mWb
21. **(a)** $B = 1{,}5\text{ T}\,(1 - e^{-\text{H}/700\text{ Ae/m}})$
(b) 900 At/m: gráfico = 1,1 T, Eq. = 1,09 T; 1.800 Ae/m: gráfico = 1,38 T, Eq. = 1,39 T; 2.700 Ae/m: gráfico = 1,47 T, Eq. = 1,47 T
Resultados excelentes
(c) $H = -700 \log_e(1 - \frac{8}{1{,}5\text{ T}})$
(d) 1 T: gráfico = 750 Ae/m, Eq. = 769,03 Ae/m; 1,4 T: gráfico = 1.920 Ae/m, Eq. = 1895,64 Ae/m
(e) 40,1 mA *vs.* 44 mA no Exemplo 12.1

Capítulo 13

1. **(a)** 10 V **(b)** 15 ms: –10 V, 20 ms: 0 V **(c)** 20 V **(d)** $T = 20$ ms **(e)** 2
3. **(a)** 40 mV **(b)** 1,5 ms: –40 mV; 5,1 ms: –40 mV **(c)** 80 mV **(d)** 2 ms **(e)** 3,5
5. **(a)** 1 Hz **(b)** 16 Hz **(c)** 25 Hz **(d)** 40 kHz
7. 0,3 ms
9. **(a)** 125 mV **(b)** 32 μs **(c)** 31,25 kHz
11. **(a)** 60° **(b)** 216° **(c)** 18° **(d)** 108°
13. **(a)** 628,32 rad/s **(b)** $1{,}57 \times 10^3$ rad/s **(c)** $12{,}56 \times 10^3$ rad/s **(d)** $25{,}13 \times 10^3$ rad/s
15. 2,78 ms
17. **(a)** 20, 60 Hz **(b)** 12.120 Hz **(c)** 10^6, 1591,55 Hz **(d)** 8, 1,6 kHz
21. 0,48 A
23. 11,54°, 168,46°
27. **(a)** $v = 6 \times 10^{-3}\ \text{sen}(2\pi\ 2.000t + 30°)$
(b) $i = 20 \times 10^{-3}\ \text{sen}(2\pi\ 60t - 60°)$
29. $v = 12 \times 10^{-3}\ \text{sen}(2\pi\ 2.000t + 135°)$
31. v adiantada 90° em relação a i
33. em fase
35. 13,95 μs
37. $\frac{1}{12}$ ms
39. 1 V
41. 2,33 V
43. **(a)** 0 V **(b)** 0 V **(c)** o mesmo
45. **(a)** 0,4 ms **(b)** 2,5 kHz **(c)** –25 mV
47. **(a)** 84,85 V **(b)** 4,24 mA **(c)** 5,66 μA
49. 1,43 V
51. $G = 0$ V, $V_{rms} = 8$ V
53. **(a)** $y = 2x \Rightarrow y^2 = 4x^2$
(b) 360 **(c)** 5,48 **(d)** 3,67
(e) rms ≅ 1,5 média

Capítulo 14

1. —
3. **(a)** $3.770 \cos 377t$
(b) $120 \cos(200t + 20°)$
(c) $4.440{,}63 \cos(157t - 20°)$
(d) $200 \cos t$
5. **(a)** $v = 700\ \text{sen}\ 1.000t$
(b) $v = 14{,}8\ \text{sen}\ (400t - 120°)$
7. **(a)** 22 mH **(b)** 1,2 H
9. **(a)** $v = 100\ \text{sen}(\omega t + 90°)$
(b) $v = 0{,}8\ \text{sen}(\omega t + 150°)$
(c) $v = 120\ \text{sen}(\omega t - 120°)$
11. **(a)** $i = 24\ \text{sen}(\omega t - 90°)$
(b) $i = 0{,}6\ \text{sen}(\omega t - 70°)$
13. **(a)** ∞ Ω **(b)** 530,79 Ω **(c)** 15,92 Ω **(d)** 62,83 Ω
15. **(a)** 4,08 kHz **(b)** 34 Hz **(c)** 408,09 kHz **(d)** 20,40 Hz
17. **(a)** $i = 6 \times 10^{-3}\ \text{sen}(200t + 90°)$
(b) $i = 22{,}64 \times 10^{-6}\ \text{sen}(377t + 90°)$
19. **(a)** $v = 1.190{,}48\ \text{sen}(300t - 90°)$
(b) $v = 37{,}81\ \text{sen}(377t - 120°)$
21. **(a)** $X_C = 400\ \Omega$
(b) $X_L = 40\ \Omega$, $L = 254{,}78$ mH
(c) $R = 5\Omega$
23. —
25. 318,47 mH
27. 5.070 pF
29. 192 W em cada caso
31. $i = 40\ \text{sen}\ (\omega t - 50°)$
33. **(a)** $i = 4{,}27\ \text{sen}\ (1.000t - 30°)$
(b) 30 mH **(c)** 0 W
35. **(a)** $i_1 = 2{,}4\ \text{sen}(10^4 t + 150°)$, $i_2 = 12\ \text{sen}\ (10^4 t + 150°)$
(b) $i_s = 14{,}40\ \text{sen}(10^4 t + 150°)$
37. **(a)** $5{,}0\ \angle 36{,}87°$ **(b)** $2{,}83\ \angle 45°$
(c) $12{,}65\ \angle 7{,}57°$
(d) $1.001{,}25\ \angle 2{,}86°$
(e) $4.123{,}11\ \angle 104{,}04°$
(f) $0{,}894\ \angle 116{,}57°$
39. **(a)** $4{,}6 + j\ 3{,}86$
(b) $-6{,}0 + j\ 10{,}39$ (c) $-j\ 2.000$
(d) $-0{,}006 - j\ 0{,}0022$
(e) $47{,}97 + j\ 1{,}68$
(f) $4{,}7 \times 10^{-4} - j\ 1{,}71 \times 10^{-4}$
41. **(a)** $11{,}8 + j\ 7{,}0$
(b) $151{,}90 + j\ 49{,}90$
(c) $4{,}72 \times 10^{-6} + j\ 71$
43. **(a)** $7{,}03 + j\ 9{,}93$
(b) $95{,}7 + j\ 22{,}77$
(c) $28{,}07\ \angle -115{,}91°$