

$$(1) Z_L = j\omega L = j2\pi fL = j \times 2 \times 3.14 \times 10^3 \times 10^{-3} = j6.28 [\Omega]$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j2\pi fC} = \frac{1}{j \times 2 \times 3.14 \times 10^3 \times 30 \times 10^{-6}} = -j5.31 [\Omega]$$

$$Z = Z_R + \frac{1}{\frac{1}{Z_L} + \frac{1}{Z_C}} = Z_R + \frac{Z_L Z_C}{Z_L + Z_C} = 5 + \frac{j6.28 \times (-j5.31)}{j6.28 + (-j5.31)} = 5 - j34.4 [\Omega]$$

$$(2) Z_L = j\omega L = j2\pi fL = j \times 2 \times 3.14 \times 10^3 \times 2 \times 10^{-3} = j12.6 [\Omega]$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j2\pi fC} = \frac{1}{j \times 2 \times 3.14 \times 10^3 \times 10 \times 10^{-6}} = -j15.9 [\Omega]$$

$$\begin{aligned} Z &= Z_L + \frac{1}{\frac{1}{Z_C} + \frac{1}{Z_R}} = Z_L + \frac{Z_C Z_R}{Z_C + Z_R} = j12.6 + \frac{(-j15.9) \times 5}{(-j15.9) + 5} = j12.6 + \frac{(-j79.5)(5 + j15.9)}{(5 - j15.9)(5 + j15.9)} \\ &= j12.6 + \frac{-j397.5 + 1264}{25 + 253} = j12.6 - j1.43 + 4.55 = 4.55 + j11.2 [\Omega] \end{aligned}$$

$$(3) Z_L = j\omega L = j2\pi fL = j \times 2 \times 3.14 \times 10^3 \times 3 \times 10^{-3} = j18.8 [\Omega]$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j2\pi fC} = \frac{1}{j \times 2 \times 3.14 \times 10^3 \times 15 \times 10^{-6}} = -j10.6 [\Omega]$$

$$\begin{aligned} Z &= Z_C + \frac{1}{\frac{1}{Z_L} + \frac{1}{Z_R}} = Z_C + \frac{Z_L Z_R}{Z_L + Z_R} = -j10.6 + \frac{(j18.8) \times 5}{(j18.8) + 5} = -j10.6 + \frac{j94 \times (5 - j18.8)}{(5 + j18.8)(5 - j18.8)} \\ &= j10.6 + \frac{j470 + 1767}{25 + 354} = -j10.6 + j1.26 + 4.66 = 4.66 - j9.34 [\Omega] \end{aligned}$$

$$(4) Z_L = j\omega L = j2\pi fL = j \times 2 \times 3.14 \times 10^3 \times 3 \times 10^{-3} = j18.8 [\Omega]$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j2\pi fC} = \frac{1}{j \times 2 \times 3.14 \times 10^3 \times 10 \times 10^{-6}} = -j15.9 [\Omega]$$

$$Z = \frac{1}{\frac{1}{Z_C} + \frac{1}{Z_L + Z_R}} = \frac{Z_C \times (Z_L + Z_R)}{Z_C + (Z_L + Z_R)} = \frac{-j15.9 \times (j18.8 + 10)}{-j15.9 + (j18.8 + 10)} = \frac{299 - j159}{10 + j2.9}$$

$$= \frac{(299 - j159)(10 - j2.9)}{(10 + j2.9)(10 - j2.9)} = \frac{2990 - j867 - j1590 - 461}{100 + 8.41} = \frac{2529 - j2457}{108} = 23.4 - j22.8 \Omega$$

$$(5) Z_C = \frac{1}{j\omega C} = \frac{1}{j2\pi fC} = \frac{1}{j \times 2 \times 3.14 \times 10^3 \times 15 \times 10^{-6}} = -j10.6 [\Omega]$$

$$Z_{L1} = j\omega L_1 = j2\pi fL_2 = j \times 2 \times 3.14 \times 10^3 \times 2 \times 10^{-3} = j12.6 [\Omega]$$

$$Z_{L2} = j\omega L_2 = j2\pi fL_2 = j \times 2 \times 3.14 \times 10^3 \times 10^{-3} = j6.28 [\Omega]$$

$$Z = Z_C + Z_{L1} + \frac{1}{\frac{1}{Z_{L2}} + \frac{1}{Z_R}} = Z_C + Z_{L1} + \frac{Z_{L2}Z_R}{Z_{L2} + Z_R} = -j10.6 + j12.6 + \frac{j6.28 \times 10}{j6.28 + 10} = 2.83 + j6.50 [\Omega]$$

$$(6) Z_L = j\omega L = j2\pi fL = j \times 2 \times 3.14 \times 10^3 \times 10^{-3} = j6.28 [\Omega]$$

$$Z_C = \frac{1}{j\omega C} = \frac{1}{j2\pi fC} = \frac{1}{j \times 2 \times 3.14 \times 10^3 \times 10 \times 10^{-6}} = -j15.9 [\Omega]$$

$$Z = \frac{1}{\frac{1}{Z_L + Z_{R1}} + \frac{1}{Z_{R2}} + \frac{1}{Z_C}} = \frac{1}{\frac{1}{j6.28 + 5} + \frac{1}{10} + \frac{1}{-j15.9}} = 5.43 + j1.06 [\Omega]$$