

問1

(1) 抵抗のインピーダンスは周波数には関係ないので $10[\Omega]$

(2) $Z_L = j\omega L = j \times 2 \times \pi \times 1 \times 10^3 \times 1.59 \times 10^{-3} \approx j9.99 \approx j10 [\Omega]$

(3) $Z_C = \frac{1}{j\omega C} = \frac{1}{j \times 2 \times \pi \times 1 \times 10^3 \times 15.9 \times 10^{-6}} \approx -j10 [\Omega]$

問2

(1) $Z = Z_{R1} + Z_{R2} = 5 + 15 = 20 [\Omega]$

(2) $Z = Z_{C1} + Z_{C2} = (-j10) + (-j10) = -j20 [\Omega]$

(3) $Z = Z_{L1} + Z_{L2} = j10 + j10 = j20 [\Omega]$

(4) $Z = Z_R + Z_C = 10 + (-j10) = 10 - j10 [\Omega]$

(5) $Z = Z_R + Z_L = 10 + j10 [\Omega]$

(6) $Z = Z_C + Z_L = -10j + j20 = j10 [\Omega]$

(7) $Z = Z_C + Z_L + Z_R = -10j + j20 + 10 = 10 + j10 [\Omega]$

問3

(1) $Z = \frac{1}{\frac{1}{Z_{R1}} + \frac{1}{Z_{R2}}} = \frac{Z_{R1} \times Z_{R2}}{Z_{R1} + Z_{R2}} = \frac{10 \times 10}{10 + 10} = 5 [\Omega]$

(2) $Z = \frac{1}{\frac{1}{Z_{C1}} + \frac{1}{Z_{C2}}} = \frac{Z_{C1} \times Z_{C2}}{Z_{C1} + Z_{C2}} = \frac{(-j10) \times (-j10)}{(-j10) + (-j10)} = \frac{-100}{-j20} = -j5 [\Omega]$

(3) $Z = \frac{1}{\frac{1}{Z_{L1}} + \frac{1}{Z_{L2}}} = \frac{Z_{L1} \times Z_{L2}}{Z_{L1} + Z_{L2}} = \frac{(j10) \times (j10)}{(j10) + (j10)} = \frac{-100}{j20} = j5 [\Omega]$

(4) $Z = \frac{1}{\frac{1}{Z_R} + \frac{1}{Z_C}} = \frac{Z_R \times Z_C}{Z_R + Z_C} = \frac{(10) \times (-j10)}{10 - j10} = \frac{-j100 \times (10 + j10)}{(10 - j10)(10 + j10)} = \frac{-j1000 + 1000}{200} = 5 - j5 [\Omega]$

(5) $Z = \frac{1}{\frac{1}{Z_R} + \frac{1}{Z_L}} = \frac{Z_R \times Z_L}{Z_R + Z_L} = \frac{(10) \times (j10)}{10 + j10} = \frac{j100 \times (10 - j10)}{(10 + j10)(10 - j10)} = \frac{j1000 + 1000}{200} = 5 + j5 [\Omega]$

(6) $Z = \frac{1}{\frac{1}{Z_C} + \frac{1}{Z_L}} = \frac{Z_C \times Z_L}{Z_C + Z_L} = \frac{(-j10) \times (j20)}{-j10 + j20} = \frac{200}{j10} = -j20 [\Omega]$