i) $\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(20\times10^{-3})\times(5\times10^{-3})}}$

$= 100\text{ K rad/s}$

$B = \frac{\omega_0}{Q} = \frac{1}{RC} = \frac{1}{100\times(5\times10^{-3})}$

$= 2\text{ K rad/s}$

$Q = \frac{\omega_0}{B} = \frac{100\times10^3}{2\times10^3} = 50$

Since $Q \geq 10$

$-\omega_1 = \omega_0 - B/2 = 100\times10^3 - \frac{2\times10^3}{2} = 99\text{ K rad/s}$

$\omega_2 = \omega_0 + B/2 = 100\times10^3 + \frac{2\times10^3}{2} = 101\text{ K rad/s}$

ii) Input admittance :

$Y = j\omega 0.1 + \frac{1}{10} + \frac{1}{2+j\omega_2}$

$= 0.1 + j\omega_0 \cdot 1 + \frac{2-j\omega_2}{4+4\omega^2}$

at Resonance

$Im(Y) = 0$

$\omega_0 0.1 = \frac{2\omega_0}{4+\omega_0^2} = 0$

$\omega_0 = 2\text{ rad/s}$

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3) $\dfrac{20 + \frac{2000}{j\omega}}{20 + \frac{2000}{j\omega}} = \dfrac{4000}{20j\omega + 2000} - \dfrac{4000}{20j\omega + 2000} + \dfrac{(20j\omega - 2000)}{(20j\omega - 2000)}$

$= \dfrac{800j\omega - 8000000}{-400j\omega - 4000000} + 100mH$

At resonance of the imaginary part at $\omega = 0$

$\dfrac{80,000j\omega}{-400j\omega - 4000000} + j\omega\left[100 \times 10^{-3}\right]$

$= 800000\omega + \left[-40\omega^2\right] - 400000\omega$

$= 400000\omega - 40\omega^2 = 0$

$-40\omega^2 = -400000$

$\omega^2 = 10000$

$\omega = \sqrt{10000}$

$\omega = 100$ rad/s

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