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Circuit Theory.

i.) Parameters.

$R = 100k\Omega$, $L = 20mH$, $C = 5nf$.

Conversion

$R = 100 \times 10^2$, $L = 20 \times 10^{-3} H$, $C = 5 \times 10^{-9}$

$= 10000$

a.) $\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{20 \times 10^{-3} \times 5 \times 10^{-9}}}$

$= \frac{1}{\sqrt{100 \times 10^{-12}}} = \frac{1}{10 \times 10^{-6}}$

$= 10^{-1} \times 10^6$

$= 10^5$

$= 100 krad/s$.

b.) $Q = \frac{R}{\omega_0 L} = \frac{100,000}{100 \times 10^5 \times 20 \times 10^{-3}}$

$= 1/20 \times 10^3$

0.05×10^3

$= 50$

$B = \frac{\omega_0}{Q} = \frac{100 \times 10^3}{50} = 2000 rad/s = 2k/s$

$\omega_1 = \omega_0 - \frac{B}{2} = 100000 - \frac{2000}{2}$

$= 100000 - 1000$

$= 99,000 = 99 krad/s$

$$w_2 = w_0 + \frac{\beta}{2} = 100{,}000 + \frac{2000}{2}.$$

$$100{,}000 + 1000$$

$$= 101000 \text{ rad/s}.$$

$$= 101 \text{ krad/s}$$

2.

The input admittance is

$$Y = j\omega 0.1 + \frac{1}{10} + \frac{1}{2 + j\omega 2} = 0.1 + j\omega 0.1 + \frac{2 - j\omega 2}{4 + 4\omega^2}$$

At resonance, $Im(Y) = 0$ and

$$\omega_0 0.1 - \frac{2\omega_0}{4 + 4\omega_0^2} = 0 \Rightarrow \omega_0 = 2 \text{ rad/s}.$$

Sol 4)

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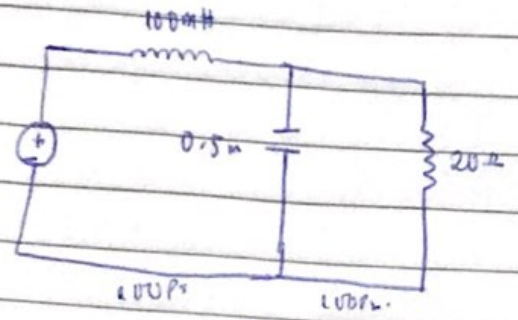

$100mH = (100 \times 10^{-3})H \longrightarrow L$	$(100 \times 10^{-3})j\omega H$
$0.5mF = (0.5 \times 10^{-3})F \longrightarrow C$	$(0.5 \times 10^{-3}) = 1/2000 = 2000/j\omega$
$20\Omega \longrightarrow R$	20Ω

From Loop 2.

R//C

$$\frac{20 \times \frac{2000}{j\omega}}{20 + \frac{2000}{j\omega}}$$ i.e Product / sum.

$$\Rightarrow \frac{40000}{20j\omega + 200} \Rightarrow \frac{40000}{20j\omega + 2000} \times \frac{(20j\omega - 2000)}{(20j\omega + 2000)}$$ (cut imaginary

$$\Rightarrow \frac{800000j\omega - 80000000}{-400j\omega - 4000000}$$

R = L + (R//C) since the inductor is in series

$$\frac{80000j\omega - 80000000}{-400j\omega - 4000000} + (100 \times 10^{-3})j\omega.$$

at resonance Im(R)

$$= \frac{800000j\omega}{-400j\omega - 4000000} + j\omega(100 \times 10^{-3})$$

$400000\omega_0 + (-40\omega^2) - 400000 j\omega_0$

$400000 - 40\omega^2 = 0$

$\omega^2 = 10000$

$\omega = 100 \text{ rad/s}$.