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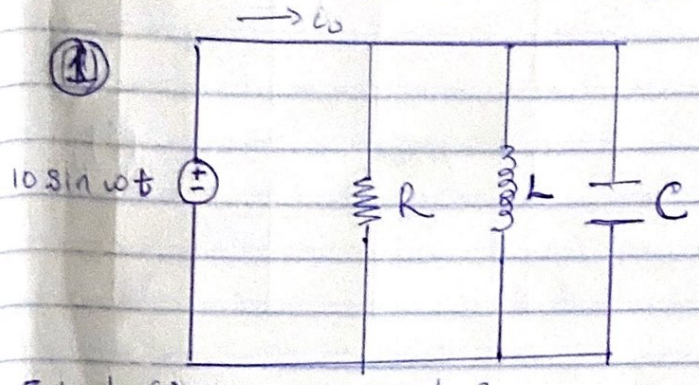
17/Eng04/014
EEE 322 [Circuit theory].

(1)



Find (i) ω_o, Q and B

(i)

$$\omega_o = 1/\sqrt{LC} = \frac{1}{\sqrt{20 \times 10^{-3} \times 5 \times 10^{-9}}}$$

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

$$= 10^5$$

$$\omega_o = 100 \text{ Krad/s}$$

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

$$= \frac{1}{20} \times 10^3$$

$$= 0.05 \times 10^3$$

$$Q = 50$$

(c) $B = W_0/Q = \frac{100 \times 10^3}{50}$

$B = 2000 \text{ rad/s}$

$B = 2 \text{ Krad/s}$.

(2) Calculate w_1, w_2

(1) $W_1 = W_0 - \frac{B}{2} = 100000 - \frac{2000}{2}$

$W_1 = 100000 - 1000$

$W_1 = 99,000$

$W_1 = 99 \text{ Krad/s}$

(2) $W_2 = W_0 + \frac{B}{2} = 100000 + \frac{2000}{2}$

$= 100000 + 1000$

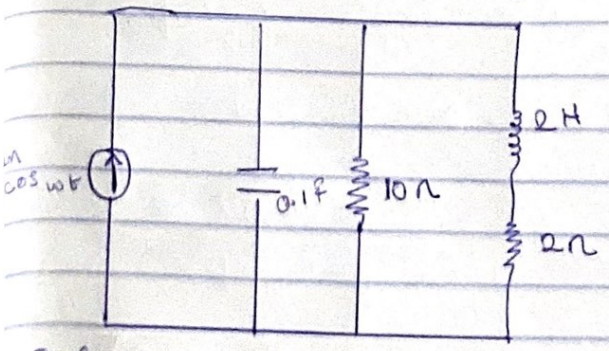
$= 101000 \text{ rad/s}$

$W_2 = 101 \text{ Krad/s}$

(3)

QUESTION 2

Determine the resonant frequency of the circuit in fig 14.28



Solution

The input admittance is

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

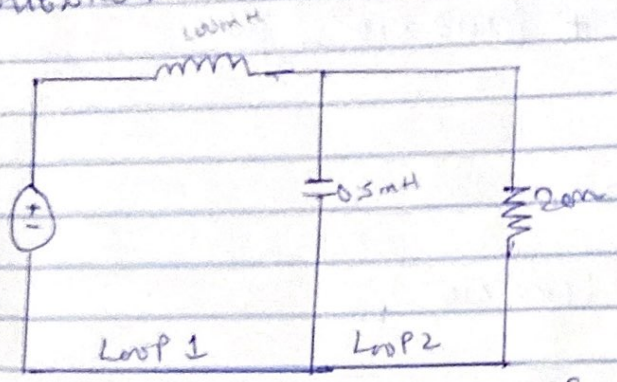
$$= 0.1 + j\omega 0.1 + \frac{2 - j\omega 2}{4 + 4\omega^2}$$

At resonance, $\text{Im}[Y] = 0$ and.

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

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

QUESTION 3



	Frequency domain
$100mH = (100 \times 10^{-3})H \rightarrow L$	$(100 \times 10^{-3})j\omega$
$0.5mf = (0.5 \times 10^{-3})f \rightarrow C$	$(0.5 \times 10^{-3}) = 1/2000 = 2000/j\omega$
$20\Omega \Leftrightarrow R$	20Ω

From Loop 2.

$R \| C$

$$\frac{20 \times \frac{2000}{j\omega}}{20 + \frac{2000}{j\omega}} \quad \text{i.e} \quad \frac{\text{Product of}}{\text{Sum of}}$$

$$\Rightarrow \frac{40000}{20j\omega + 2000} \Rightarrow \frac{4000}{20j\omega + 2000} \times \frac{(20j\omega - 2000)}{20j\omega + 2000}$$

$$\Rightarrow \frac{80,000j\omega - 80,000,000}{-400\omega^2 - 4000000}$$

From Loop 1

$R = L + [R \| C]$ since the inductor is in series.

$$\frac{800000jw - 8000000w}{-400jw - 4000000} + [100 \times 10^{-3}]jw$$

at resonance Im(R)

$$= \frac{80,0000jw}{-400jw - 4000000} + jw(100 \times 10^{-3}).$$

$$80000w_0 + [-40w_0^2] - 4000000\, w_0.$$

$$400000 - 40w^2 = 0$$

$$w^2 = 10000$$

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