ELEFUNA DAVID
17/ENG05/013
MECHATRONICS ENGINEERING

Q1) $R = 100k\Omega = 100000\Omega = 1\times10^{5}\Omega$

$L = 20mH = 0.0002H = 2\times10^{-4}H$

$C = 5nF = 5\times10^{-9}F$

i) $W_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(2\times10^{-4}\times5\times10^{-9})}} = \frac{1}{\sqrt{100\times10^{-12}}}$

$= \frac{1}{10\times10^{-6}}$

$= 10^5$

$= 100 \text{ Krad/s}$

b) $Q = \frac{R}{W_0 L} = \frac{100,000}{100000\times20\times10^{-7}}$

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

$= 0.05\times10^3$

$= 50$

c) $\beta = \frac{W_0}{Q} = \frac{100\times10^3}{50} = 2 \text{ Krad/s}$

$W_1 = W_0 - \frac{\beta}{2} = 100000 - \frac{2000}{2}$

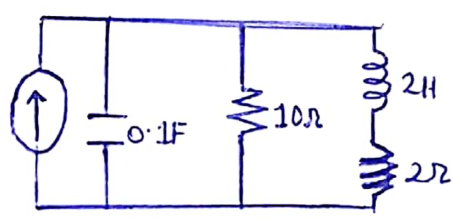
$= 99,000$

$= 99 \text{ Krad/s}$

$W_2 = W_0 + \frac{\beta}{2} = 100000 + \frac{2000}{2}$

$= 101 \text{ Krad/s}$

Q2)




The input admittance is

$Y = JW0.1 + \frac{1}{10} + \frac{1}{2+JW2}$

$= 0.1 + JW0.1 + \frac{2-JW2}{4+4W^2}$

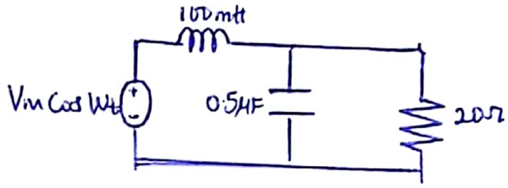
at Resonance

$Im(Y) = 0$

$\therefore W_0 0.1 = \frac{2W_0}{4+W_0^2} = 0$

$W_0 = 2 \text{ rad/s}$

Q3) Calculate the resonant frequency of the circuit below




$\frac{20+\frac{2000}{JW}}{20+\frac{2000}{JW}} = \frac{40000}{20JW+2000} - \frac{40000}{20JW+2000} + \frac{(20JW-2000)}{(20JW-2000)}$

$= \frac{80000JW - 80\times10^6}{-400JW - 40\times10^5} + 100mH$

At Resonance of the imaginary part at $W=0$

$= \frac{80\times10^4 JW}{-400JW - 40\times10^5} + JW(100\times10^{-3})$

$= 80\times10^4 W + (-40W^2) - 40\times10^4 W$

$0 = 40\times10^4 - 40W^2$

$-40W^2 = -40\times10^4$

$W^2 = 10000$

$W = \sqrt{10000}$

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