

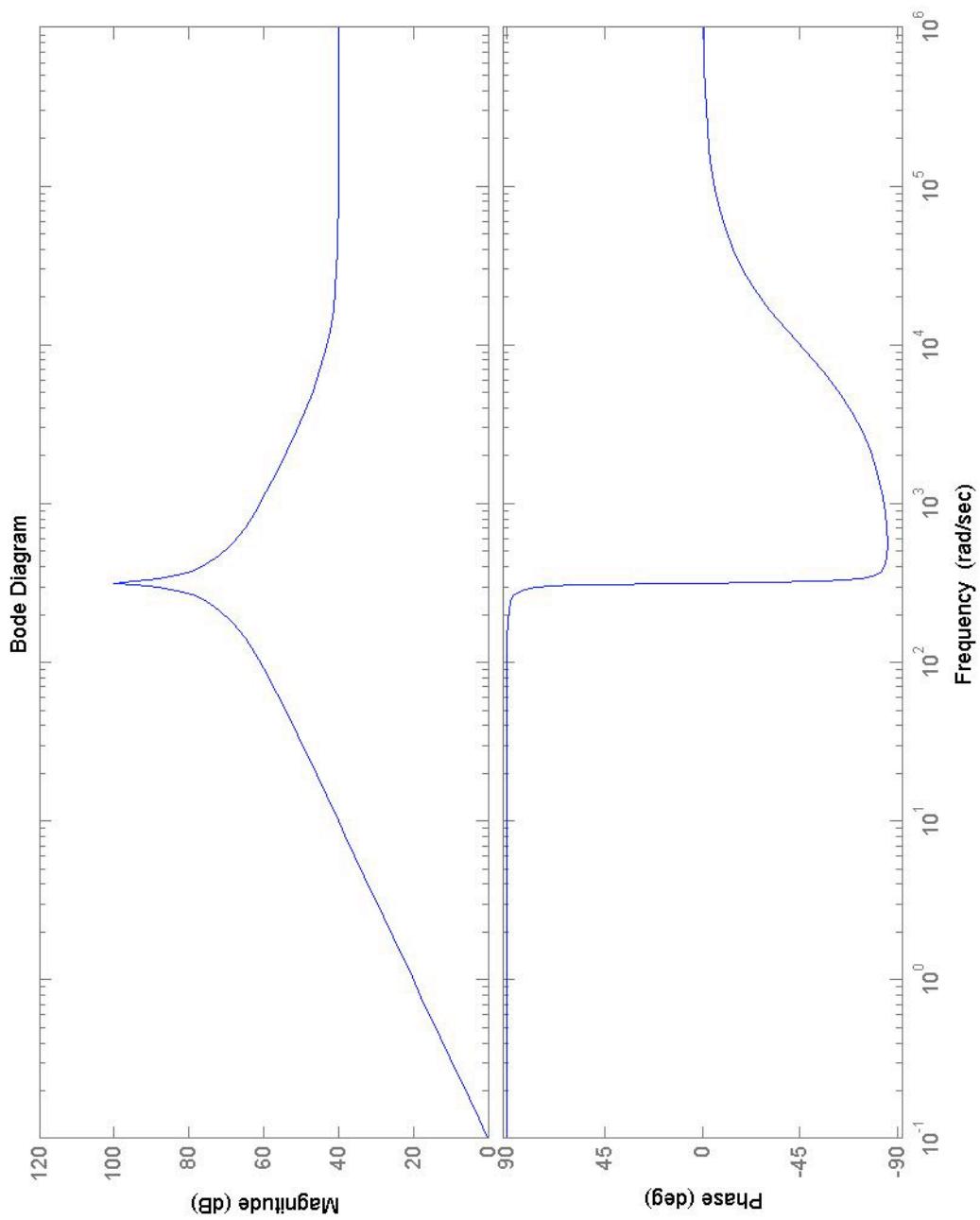
Homework 5 - Answers

① $\textcircled{A} \quad Z = \frac{Z_1 Z_2}{Z_1 + Z_2} = \frac{\left(R + \frac{1}{j\omega C}\right) j\omega L}{\left(R + \frac{1}{j\omega C}\right) + j\omega L}$

$$= \frac{-RCL\omega^2 + j\omega L}{j\omega RC + 1 - LC\omega^2}$$

② \textcircled{B} The question is wrong, since a Bode Plot should be a pure ratio rather than an impedance, (sorry!). The next page shows a plot anyway, normalized to 100dB.

③ \textcircled{C} Just by inspection of the circuit, at $\omega = 0$, the coil is a short circuit and $Z = 0$. At $\omega = \infty$ the capacitor is a short circuit and $Z = R$. The equation in \textcircled{A} agrees.



$$\textcircled{2} \quad \textcircled{A} \quad x - e^{-3t} u(t) + \delta(t)$$

$\downarrow F$ $\underbrace{\qquad\qquad}_{F}$ $\downarrow F$
 $4\pi S(\omega)$ $\int_0^{+\infty} e^{-3t} e^{-j\omega t} dt$ 1
 $\int_0^{+\infty} e^{-(3+j\omega)t} dt$
 $- \frac{1}{3+j\omega} e^{-(3+j\omega)t} \Big|_0^{\infty}$

$$X(\omega) = 4\pi S(\omega) - \frac{1}{3+j\omega} + 1$$

$$\textcircled{B} \quad X(\omega) = -3 \left[\int_0^{\infty} e^{-2t} e^{-j\omega t} dt + \int_{-\infty}^0 e^{2t} e^{-j\omega t} dt \right]$$

$$-3 \left[-\frac{1}{2+j\omega} e^{-(2+j\omega)t} \Big|_0^{\infty} + \frac{1}{2-j\omega} e^{(2-j\omega)t} \Big|_{-\infty}^0 \right]$$

$$-3 \left[\frac{1}{2+j\omega} + \frac{1}{2-j\omega} \right]$$

$$-3 \left[\frac{4}{4+\omega^2} \right]$$

$$X(\omega) = \frac{12}{4+\omega^2}$$