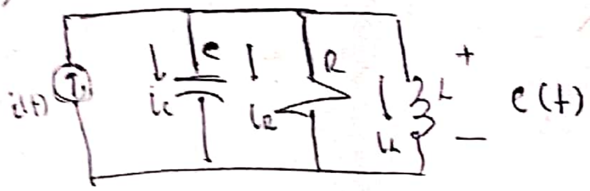
1-)



$H(s) = \frac{E(s)}{I(s)} = ?$

(1) $i = i_C + i_R + i_L$

$i = C\dot{e} + \frac{e}{R} + \frac{1}{L}\int e\,dt$

$I(s) = \left[Cs + \frac{1}{R} + \frac{1}{Ls}\right] E(s)$

$I(s) = \left[\frac{RLCs^2 + Ls + R}{RLs}\right] E(s)$

$$\boxed{\frac{E(s)}{I(s)} = \frac{RLs}{RLCs^2 + Ls + R}} \Longrightarrow \frac{E(s)}{I(s)} = \frac{1/C\, s}{s^2 + \frac{1}{RC}s + \frac{1}{LC}}$$

$H(s) = \frac{K\omega_n^2}{s^2 + 2\xi\omega_n s + \omega_n^2}$

$\boxed{\omega_n = \sqrt{\frac{1}{LC}}} \Rightarrow$ Frecuencia natural

$2\xi\omega_n = \frac{1}{RC}$

$\xi = \frac{1}{2\omega_n RC}$

$\xi = \frac{1}{2}\frac{\sqrt{LC}}{RC}$

$\xi = \frac{1}{2}\sqrt{\frac{LC}{R^2C^2}}$

$\boxed{\xi = \frac{1}{2R}\sqrt{\frac{L}{C}}}$ Factor de amortiguamiento

$K\omega_n^2 = \frac{1}{C}$

$K = \frac{1}{C\omega_n^2}$

$K = \frac{LC}{C} \Rightarrow \boxed{K = L}$ Ganancia del sistema

Código:

```
R = 1E6;
L = 1E6;
C = 1E-6;
h=tf([R*L 0],[R*L*C L R]);
step(h);
figure
pzmap(h)
```

Subamortiguado: $\xi = 0,5$

$\omega_n = 1$

$1 = \frac{1}{LC} \Rightarrow LC = 1 \Rightarrow L = \frac{1}{C}$

$0,5 = \frac{0,5}{R}\sqrt{\frac{L}{C}}$

$R = \sqrt{\frac{1}{C^2}}$

$R = \frac{1}{C}$

$\boxed{C = 1\mu F}$

$\boxed{R = 1M\Omega}$

$\boxed{L = 1MH}$

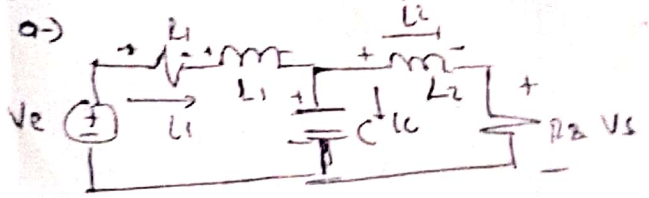
2-)

$$\boxed{H(s) = \frac{\theta_{21}(s)}{\theta_{12}(s)} = 0}$$

$\theta_{12}(t)$ no influye en la salida $\theta_{21}(t)$.

3-)

a-)



(3) $i_1 = i_2 + i_C$

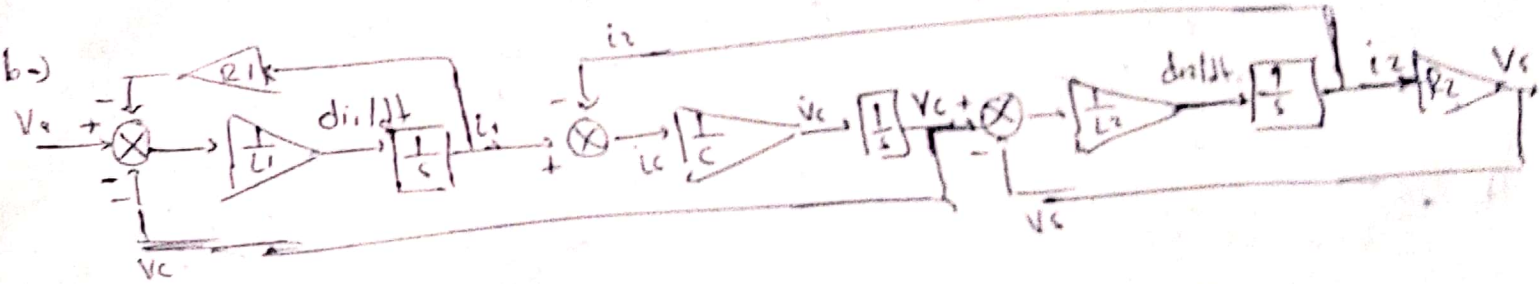
(4) $i_C = C\dot{V}_C$

(5) $V_S = i_2 R_2$

(1) $V_e = i_1 R_1 + L_1 \frac{di_1}{dt} + V_C$

(2) $V_C = L_2 \frac{di_2}{dt} + V_S$

b-)



c-) $x = \begin{bmatrix} i_1 \\ i_2 \\ V_C \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$; $u = V_e$; $y = V_S = i_2 R_2 = x_2 R_2$

$\dot{x}_1 = \frac{di_1}{dt} = \frac{V_e - i_1 R_1 - V_C}{L_1}$

$$\boxed{\dot{x}_1 = \frac{u}{L_1} - \frac{R_1}{L_1}x_1 - \frac{x_3}{L_1}}$$

$\dot{x}_2 = \frac{V_C - V_S}{L_2} = \frac{di_2}{dt}$

$$\boxed{\dot{x}_2 = \frac{x_3 - x_2 R_2}{L_2}}$$

$\dot{x}_3 = \dot{V}_C = \frac{i_C}{C} = \frac{i_1 - i_2}{C} =$

$$\boxed{\dot{x}_3 = \frac{x_1 - x_2}{C}}$$

$$\boxed{\begin{aligned} \dot{x} &= \begin{bmatrix} -R_1/L_1 & 0 & -1/L_1 \\ 0 & -\frac{R_2}{L_2} & \frac{1}{L_2} \\ \frac{1}{C} & -\frac{1}{C} & 0 \end{bmatrix} x + \begin{bmatrix} \frac{1}{L_1} \\ 0 \\ 0 \end{bmatrix} u \\ y &= \begin{bmatrix} 0 & R_2 & 0 \end{bmatrix} x \end{aligned}}$$