Q1)

By KVL:

$$V_{in} = iR + L\frac{di}{dt} + \frac{1}{C}\int i\,dt$$

Since $\frac{dq}{dt} = i$

(1) $$V_{in} = R\frac{dq}{dt} + L\frac{d^2q}{dt^2} + \frac{q}{C}$$

(2) $$V_c = \frac{1}{C}\int i\,dt = \frac{q}{C}$$

converting them to p-notation

(3) $$V_{in} = Rpq + Lp^2q + \frac{q}{C} = q(Lp^2 + R$$

(4) $$V_{out} = \frac{q}{C}$$

Transfer fuction of (3)

$$V_c = \frac{1}{C}\int i\,dt = \frac{q}{C}$$

converting them to p-

(1) [illegible]

(2)

(3) $V_{in} = Rpq + Lp^2q + \frac{q}{C}$

(4) $V_{out} = \frac{q}{C}$

Transfer function at (3)

$$H = \frac{q}{V_{in}} = \frac{1}{Lp^2 + Rp + \frac{1}{C}}$$

char eqn at (3)

$Lp^2 + Rp + \frac{1}{C} = 0$

$$= \frac{q}{C}$$

tem to p-notation

$$+ Lp^2q + \frac{q}{C} = q\left(Lp^2 + Rp + \frac{1}{C}\right)$$

tion at (3)

$$+ Rp + \frac{1}{C}$$

at (3)

$\frac{1}{\quad} = 0$

converting item to p-notation

(1) [illegible]

(2)

(3) $V_{in} = Rpq + Lp^2q + \frac{q}{C} = q(Lp^2$

(4) $V_{out} = \frac{q}{C}$

Transfer function at (3)

$$H = \frac{q}{V_{in}} = \frac{1}{Lp^2 + Rp + \frac{1}{C}}$$

char eqn at (3)

$$Lp^2 + Rp + \frac{1}{C} = 0$$

$$p = -\frac{R}{2L} \pm j\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$ ✓

char eqn at general form

$$p^2 + 2\zeta\omega_0 p + \omega_0^2 = 0$$

Char eqn (3)

$$p^2 + \frac{R}{L}p + \frac{1}{LC} = 0$$

Char eqn gen' form

$$p^2 + 2\zeta\omega_0 p + \omega_0^2 = 0$$

$$\therefore \quad \omega_0 = \sqrt{\frac{1}{LC}} = \frac{1}{\sqrt{LC}}$$

$$2\zeta\omega_0 = \frac{R}{L}$$

$$\zeta = \left(\frac{R}{L}\right) \div 2\omega_0 =$$

$$\omega_0 = \sqrt{\frac{1}{LC}} = \frac{1}{\sqrt{LC}}$$

$$2\zeta\omega_0 = \frac{R}{L}$$

$$\zeta = \left(\frac{R}{L}\right) \div 2\omega_0 =$$

$$\zeta = \frac{\frac{R}{L}}{\left(\frac{2}{\sqrt{LC}}\right)} = \frac{\frac{R}{2L}}{\sqrt{LC}} =$$

$$\zeta = \frac{R\sqrt{LC}}{2L} = \frac{R\sqrt{\quad}}{2}$$

$$\zeta = \frac{R}{2}\sqrt{\frac{C}{L}}$$

$$\omega_0 = \frac{R}{L}$$

$$\left(\frac{R}{L}\right) \div 2\omega_0 = \frac{R}{L} \div \left(\frac{2}{\sqrt{LC}}\right) = \frac{\frac{R}{2L}}{\frac{1}{\sqrt{LC}}} = R \cdot \frac{\sqrt{LC}}{2L}$$

$$\zeta = \frac{R\sqrt{LC}}{2L} = \frac{R\sqrt{\frac{C}{L}}}{2}$$

$$\zeta = \frac{R}{2}\sqrt{\frac{C}{L}}$$

output is shared to