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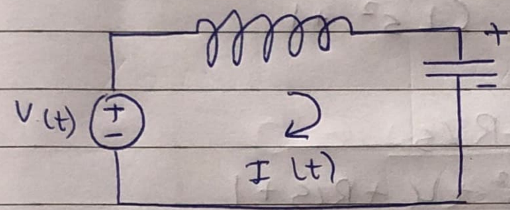
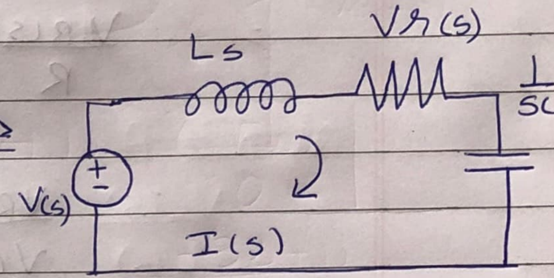
FCS   MIS 142103012

Assignment - 1

Q1) Find transfer function of RLC circuit $\left(\frac{V_R(s)}{V(s)}\right)$

a) By mesh analysis :





Laplace
Equation circuit

wkt , $V = I R_{eq}$

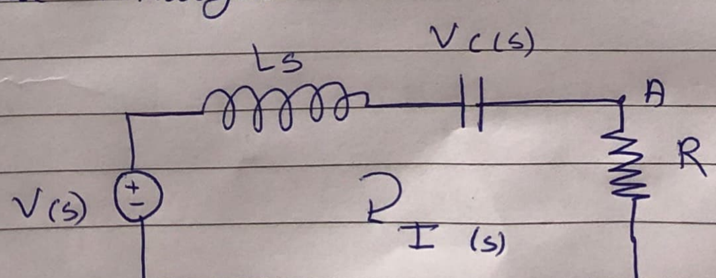
$$V(s) = I(s)\left(R + Ls + \frac{1}{SC}\right)$$

$$VR(s) = I(s) \times R$$

$$VR(s) = V(s)\left(\frac{R}{R + Ls + \frac{1}{SC}}\right)$$

$$\frac{VR(s)}{V(s)} = \frac{R}{R + Ls + 1/SC}$$

b) By nodal Analysis



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At node A,

$$\frac{V_R(s)}{R} + \frac{V_R(s) - V(s)}{Ls + 1/Cs} = 0$$

$$= \frac{V_R(s)}{R} + \frac{(V_R(s) - V(s))\,sC}{CLs^2 + 1} = 0$$

$$\therefore \frac{V_R(s)}{V(s)} = \frac{RCs}{s^2 + LC + RCs + 1}$$

$$= \frac{R}{R + Ls + 1/sC}$$

c) By voltage division:

Voltage across R is,

$$V_R(s) = \frac{R}{Ls + R + \frac{1}{sC}}\ V(s)$$

$$\frac{V_R(s)}{V(s)} = \frac{R}{Ls + R + \frac{1}{sC}}$$

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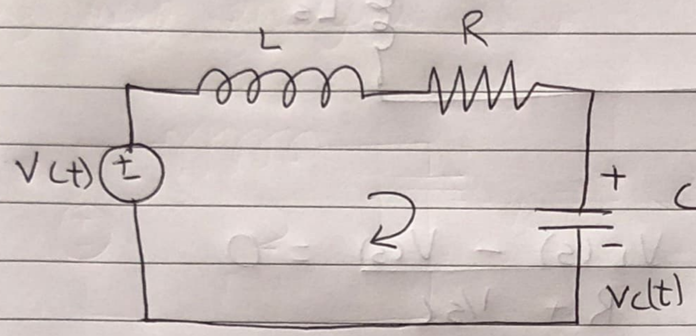
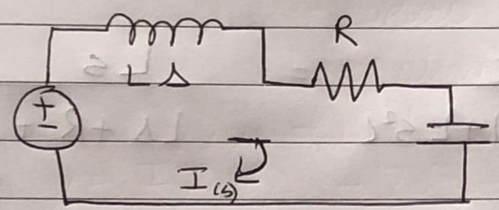
Q2) Find the transfer function of RLC circuit

$$\left(\frac{V_L(s)}{V(s)}\right)$$





Laplace equation circuit

a) By mesh analysis :

$$V = I R_{eq}$$

$$V(s) = I(s) \times \left(Ls + R + \frac{1}{Cs} \right) \quad \text{now,}$$

$$V_L(s) = I(s) \times Ls$$

Using ①, & $V_L(s) = \dfrac{V(s) \times Ls}{Ls \times R + 1/Cs}$

$$\frac{V_L(s)}{V(s)} = \frac{Ls}{Ls + R + \frac{1}{Cs}}$$

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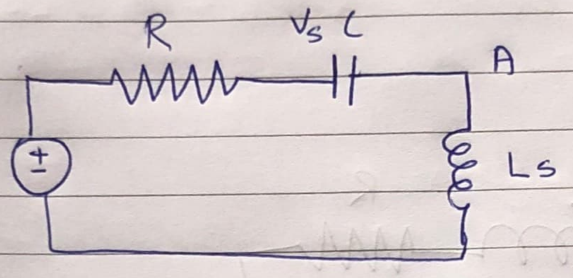
b) By nodal analysis



At node A,

$$\frac{V_L(s)}{L(s)} + \frac{V_L(s) - V(s)}{R + 1/sC} = 0$$

$$\Rightarrow \frac{V_L(s)}{V(s)} = \frac{s^2 LC}{R(s+1+Ls^2C} = \frac{Ls}{Ls + R + \frac{1}{sC}}$$

c) By voltage division

Votlage across L is

$$\frac{V_L(s)}{V(s)} = \frac{V(s)\ Ls}{Ls + R + 1/sC}$$

$$\frac{V_L(s)}{V(s)} = \frac{Ls}{Ls + R + \frac{1}{sC}}$$

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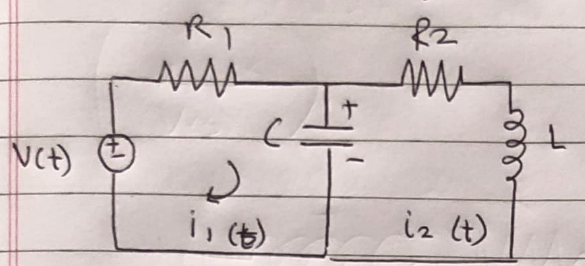
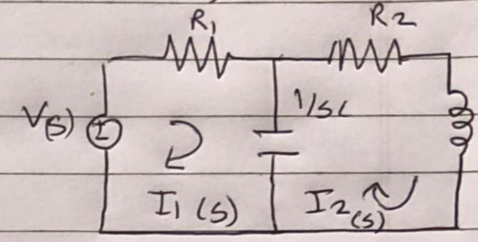
Q3) Find the transfer function $\frac{I_2(s)}{V(s)}$





In mesh — ①

$$R_1 I_1 + \frac{1}{sC} I_1(s) - \frac{1}{Cs} I_2(s) = V(s) \quad — ①$$

In mesh — ②,

$$Ls I_2(s) + R_2 I_2(s) + \frac{1}{Cs} I_2(s) - \frac{1}{Cs} I_2(s) = 0$$

On Solving

$$\frac{I_2(s)}{V(s)} = \frac{Cs}{R_1 s^3 LC^2 + (R_1 R_2 + R_1 + R_2) Cs + LCs^2}$$