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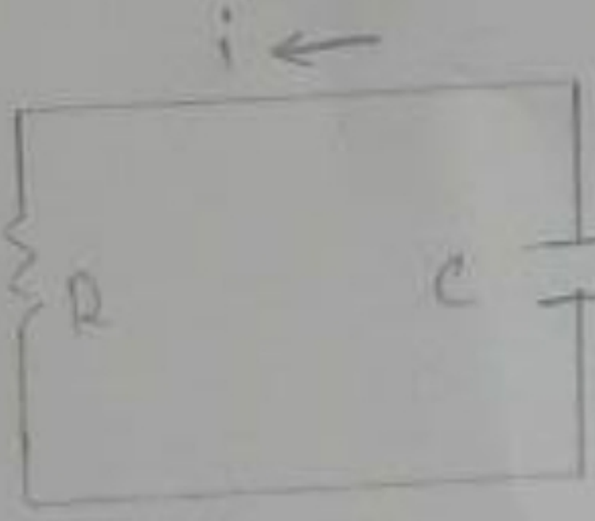
Q1: For the circuit in Fig 1, if $V = 10e^{-4t}$ & $0.2e^{-4t}$ $t > 0$

(a) Find R & C (b) .... (c) --- (d) ---

50 % of the initial energy.



Step 1

(A) $\tau = RC = \frac{1}{4}$

$\Rightarrow -1 = C\frac{dv}{dt}$

$\Rightarrow -0.2e^{-4t} = C(10)(-4)e^{-4t}$

$\Rightarrow C = 5mF$

$R = \frac{1}{4C} = 50\Omega$

Step 2

(B) $\tau = RC = \frac{1}{4} = 0.250$

Step 3

(C) $W_C(0) = \frac{1}{2}Cv^2$

$\Rightarrow \frac{1}{2}(5\times10^{-3})(100)$

$\Rightarrow 250\ mJ.$

Step 4

2

(D) $W_R = \frac{1}{2} \times \frac{1}{2} C V_0^2$

$\Rightarrow \frac{1}{2} C V_0^2 \left(1 - e^{-2t_0}\right)$

$0.5 = 1 - e^{-8t} \Rightarrow e^{-8t_0} = \frac{1}{2}$

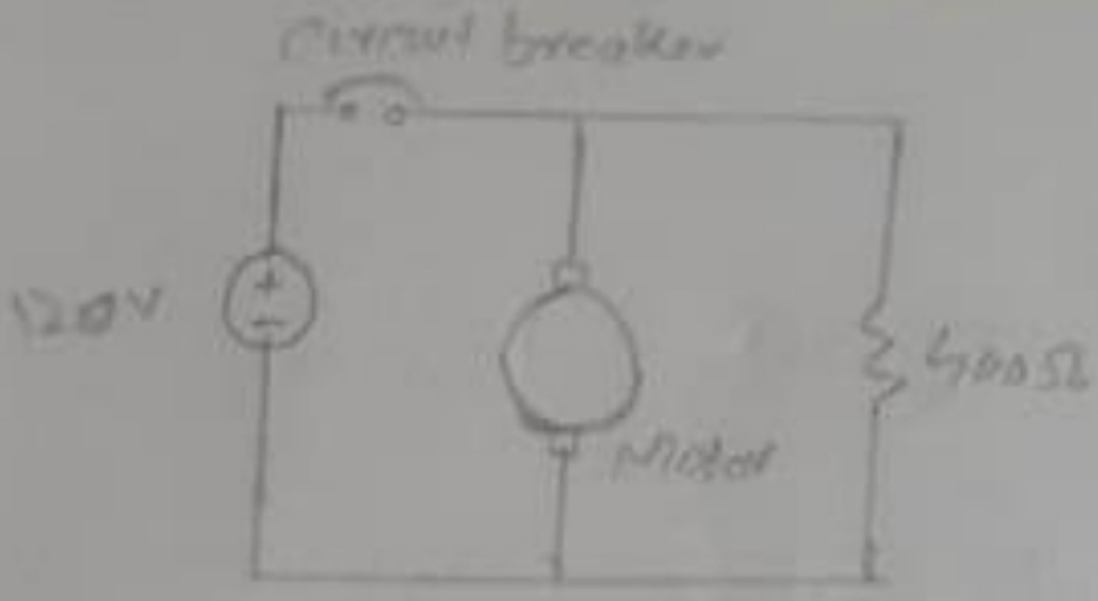
OR

$e^{8t_0} = 2$

$t_0 = \frac{1}{8} \ln(2)$

$\Rightarrow$ 88.6 ms

A 120-V dc generator energize a motor whose coil the breaker is tripped.



3

Let the inductor current.

For $t < 0$

$$i(0) = \frac{12\not{\Omega}}{10\not{\Omega}} = \frac{12}{10}$$

$$\Rightarrow \frac{6}{5} = 1.2\,A$$

For $t > 0$ We have an RL circuit

$$\tau = \frac{L}{R} = \frac{50}{100+400}$$

$$\Rightarrow \frac{5\not{\Omega}}{50\not{\Omega}} \Rightarrow \frac{5}{50}$$

$$\Rightarrow \frac{1}{10} = 0.1$$

$$i(\infty) = 0$$

$$i(t) = i(\infty) + [i(0) - i(\infty)]\, e^{-\frac{t}{\tau}}$$

$$i(t) = 1.2\, e^{-10t}$$

At $t = 100\,ms = 0.1\,s$

$$i(0.1) = 1.2e^{-1} = 0.441\,A$$

Q3

The Response of ~~RLC~~ series RLC circuit

the value of R, L, C . Determine

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Series RLC Circuit

$V_c(t) = 30 - 10e^{-20t} + 30e^{-10t}$ V

$V(t) = V_s + A_1 e^{s_1 t} + A_2 e^{s_2 t}$ $[\alpha > \omega_0]$

$40e^{-20t} - 60e^{-30t}$ mA

$\Leftrightarrow i(t) = A_1 e^{s_1 t} + A_2 e^{s_2 t}$ $[\alpha > \omega_0]$

Comparing these equ... we get

$V_s = 30$

$A_1 = -10$; $A_2 = 30$;

$S_1 = -20$; $S_2 = -10$ $\longrightarrow$ (a)

$A_1' = 40$; $A_2' = -60$;

$S_2' = -20$; $S_1' = -10$ $\rightarrow$ (b)

Step 2

NOW Equ (a) & (b)

$S_1 = -\alpha + \sqrt{\alpha^2 + \omega_0^2}$ And $S_2 = -\alpha - \sqrt{\alpha^2 - \omega_0^2}$

$S_1 + S_2 = -2\alpha$ & $S_1 S_2 = \omega_0^2$

[where $\alpha = \frac{R}{2L}$; $\omega_0 = \frac{1}{\sqrt{LC}}$]

$\Rightarrow -30 = -2\alpha$

$\Rightarrow \quad \alpha = 15$

$\Rightarrow \quad \frac{R}{2L} = 15 \rightarrow (c)$

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$200 = \alpha_0^2 \Rightarrow \frac{1}{LC} = 200 \rightarrow (d)$

Step 3

$i(t) = C \frac{dV(t)}{dt} = C\left[200e^{-20t} - 300e^{-30t}\right]$

$(A_1' e^{s_1 t} + A_2' e^{s_2 t}) \times 10^{-3} A = C\{[200e^{-20t} - 300e^{-30t}]V$

OR

$[S_1 = S_1', \quad S_2 = S_2']$

$\Rightarrow \quad 200C = A_1' = 40 \times 10^{-3}$

$\Rightarrow \quad C = 200 \times 10^{-6} F \Rightarrow C = 200 \mu F$

Using Equ # (c) & (d)

$L = \frac{1}{200C} F = \frac{1}{200 \times 200 \times 10^{-6}} \Rightarrow L = 25H$

& $R = 30L = 30 \times 25 = 750\Omega$

Q4

The circuit in Fig. 3 is the electrical analog of body Function

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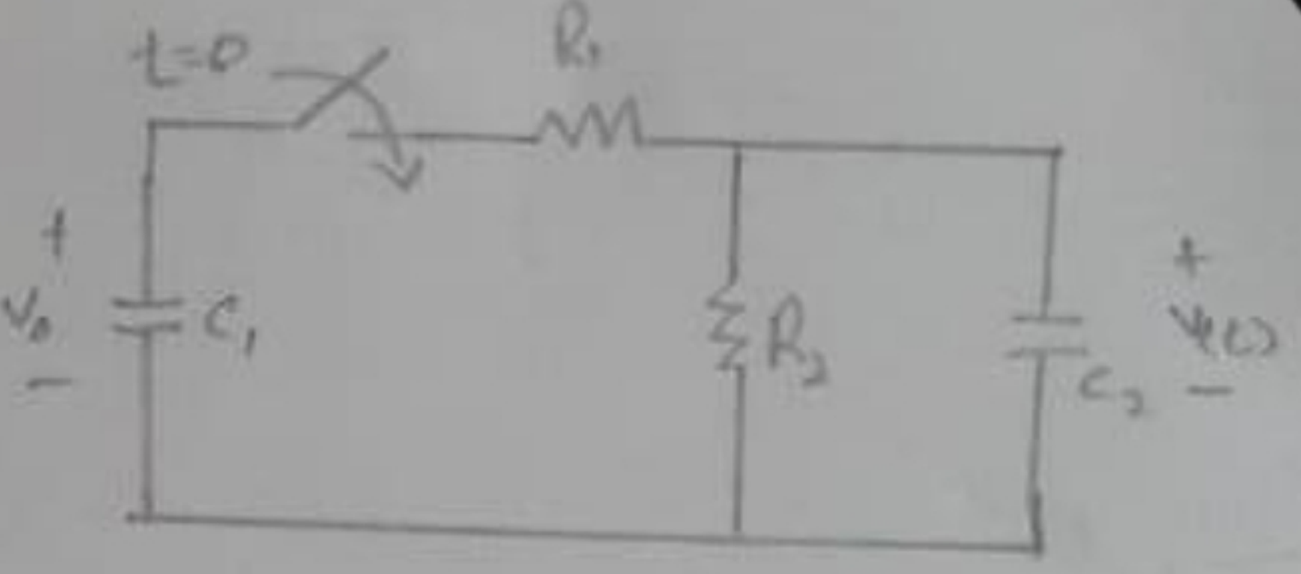
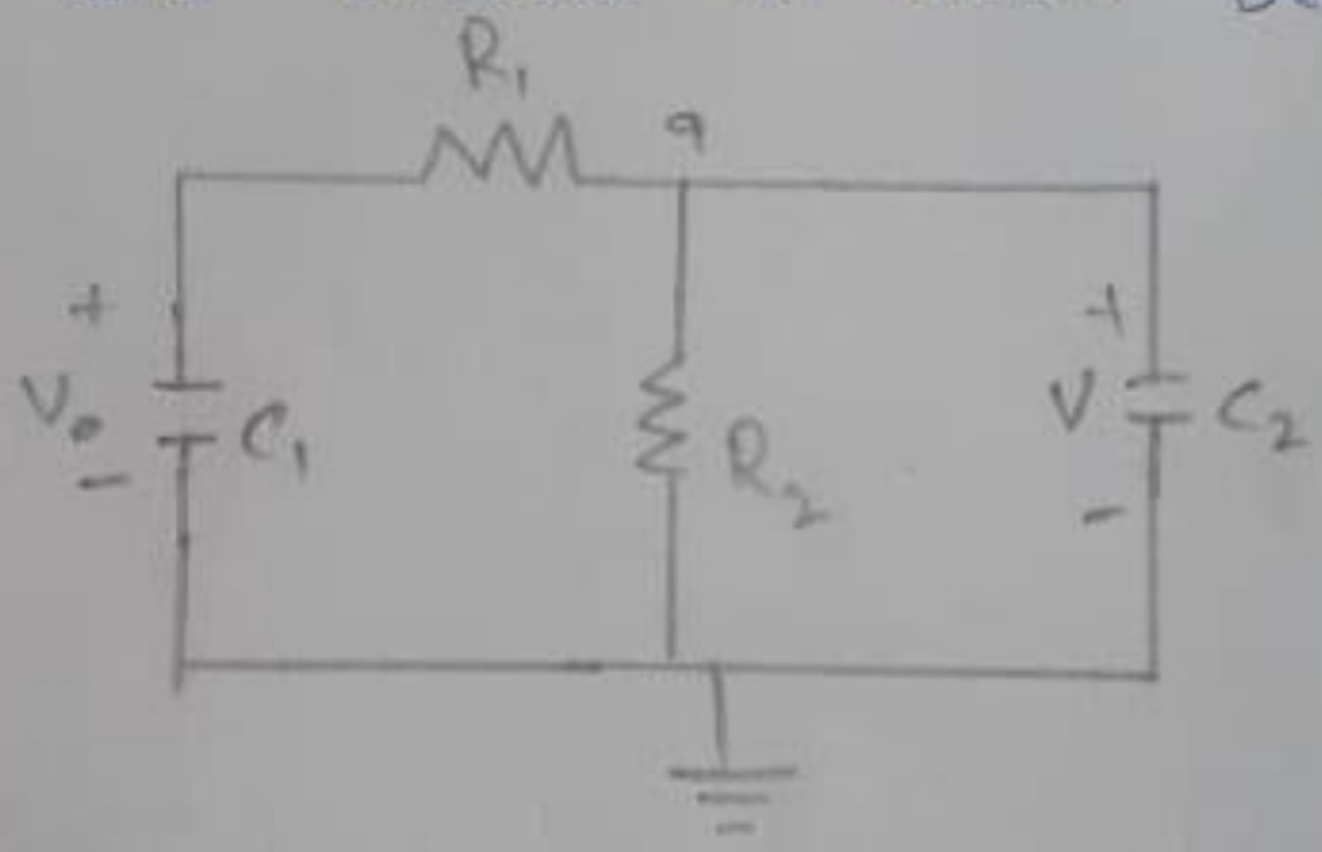


For $t = 0^-$, $V(0) = 0$

For $t > 0$ the circuit is shown below.



$$V_o - v/R_1 = (v/R_2) + C_2\, dv/dt$$

$$V_o = v(1 + R_1/R_2) + R_1 C_2\, dv/dt$$

$$60 = (1 + 5/2.5) + (5\times10^{6} \times 5 \times 10^{-6})\, dv/dt$$

$$60 = 3v + 25\, dv/dt$$

$$V(t) = V_s + [Ae^{-3t/25}]$$

Where

$3V_s = 60$ Yields $V_s = 20$

$$V(0) = \quad 0 = 20 + A \text{ or } \quad A = -20$$

$$V(t) = \quad 20\left(1 - e^{-3t/25}\right) V .$$

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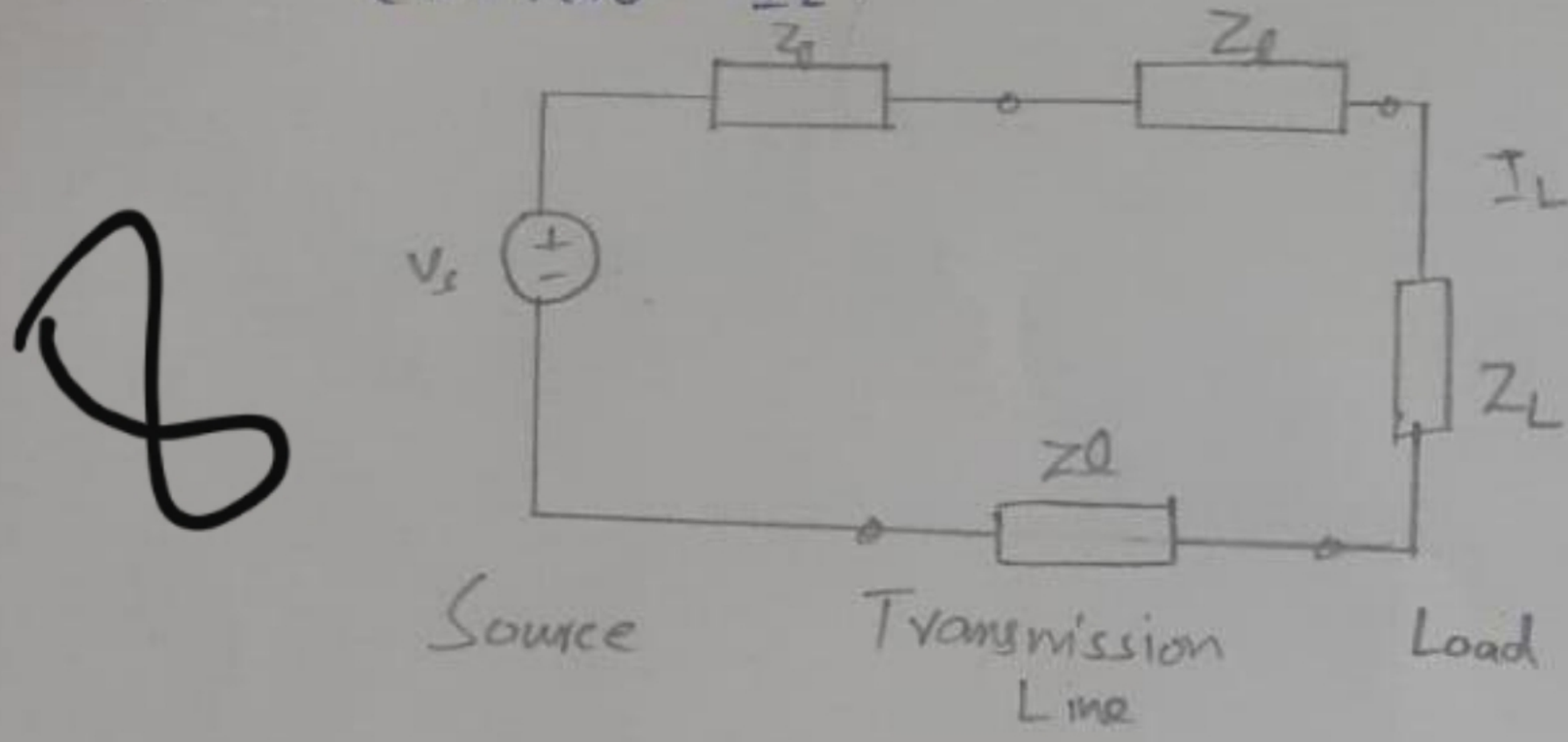
Q5

A power transmission system is modeled as shown. - - - - - Find the load current I_L.



$$Z = Z_a + 2Z + Z_\ell$$

$$= (1 + 0.8 + 23.2) + j(0.5 + 0.6 + 18.9)$$

$$Z = 25 + j20$$

$$I_L = \frac{V_s}{Z} = \frac{115\angle 0}{32.02\angle 38.66^\circ}$$

$$I_L = 3.592\angle -38.66^\circ \text{ A}$$