Sessional Assignment

Course Electric Network Analysis

Module 4th

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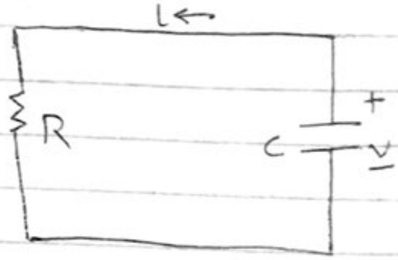
Q1:- For the circuit in Fig 1.
if $V = 10e^{-4t}$ & $0.2e^{-4t}$ $t > 0$

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

(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

$e^{8t_0} = 2$

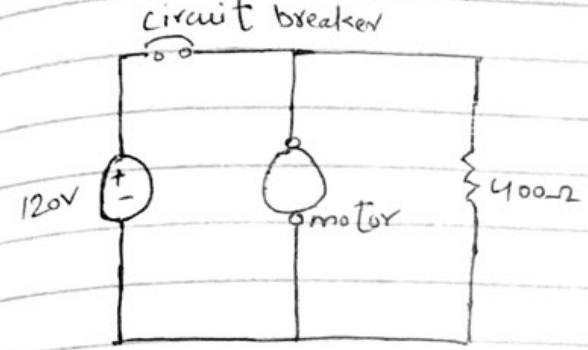
$t_0 = \frac{1}{8} \ln(2)$

$= 86.6\text{ ms.}$

Q2:-

120-V dc generator energize a motor whose coil

The breaker is tripped.



Let the inductor current.

For $t < 0$

$$i(0) = \frac{12\cancel{0}}{10\cancel{0}} = \frac{12}{10}$$

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

For $t > 0$ we have an RL circuit

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

$$= \frac{5\cancel{0}}{50\cancel{0}} \Rightarrow \frac{5}{50} \Rightarrow \frac{1}{10} \Rightarrow \boxed{0.1}$$

$$i(\infty) = 0$$

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

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

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

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

Q3:-
the Response of Series RLC circuit the value of R, L, C

Series RLC circuit
$v_o(t) = 30 - 10e^{-20t} + 30e^{-10t}$ V

$v(t) = v_o + A_1 e^{s_1 t} + A_2 e^{s_2 t}$ $[\alpha > \omega]$

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

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

Comparing these equation we get

$V_s = 30$

$A_1 = -10$; $A_2 = 30$;
$s_1 = -20$; $s_2 = -10$ —— (a)

$A_1' = 40$; $A_2' = -60$;
$s_2' = -20$; $s_2' = -10 \longrightarrow$ (b)

Step 2:-
Now Equ (a) & (b)

$s_1 = -\alpha + \sqrt{\alpha^2 + \omega_0^2}$ And $s_2 = -\alpha - \sqrt{\alpha^2 - \omega_0^2}$

$s_1 + s_2 = 2\alpha$ & $s_1 s_2 = \omega_0^2$

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

$\Rightarrow -30 = -2\alpha$

$\Rightarrow \alpha = 15$

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

$200 = \omega_0^2 \Rightarrow \frac{1}{LC} = 200 \rightarrow (d)$

Step 3:-

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

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

OR

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

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

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

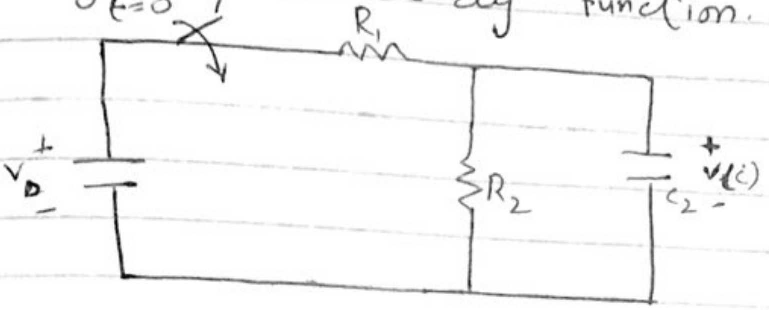
Using Equ (c) & (d)

$$L = \frac{1}{200C} F = \frac{1}{200 \times 200 \times 10^{-6}} \Rightarrow L = 20H$$

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

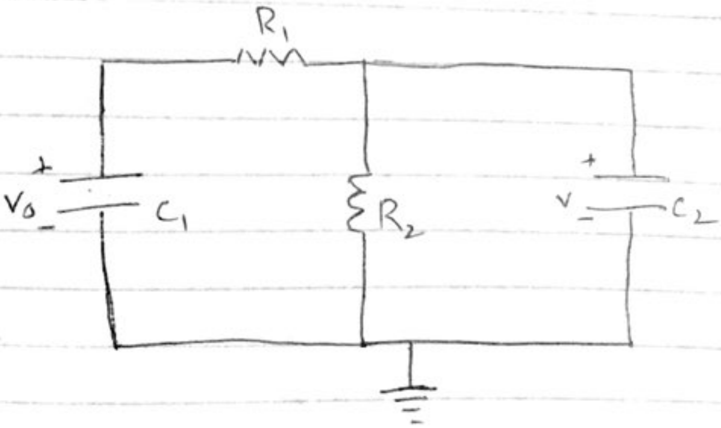
Q4s-

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



For $t = 0$ $v(0) = 0$

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



$$V_0 - v/R_1 = (v/R_2) + C_2\, dv/dt$$

$$V_0 = v(1 + R_1/R_2) + R_1 C_2\, dv/dt$$

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

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

$$v(t) = V_s + \left[Ae^{-3t/25}\right]$$

where

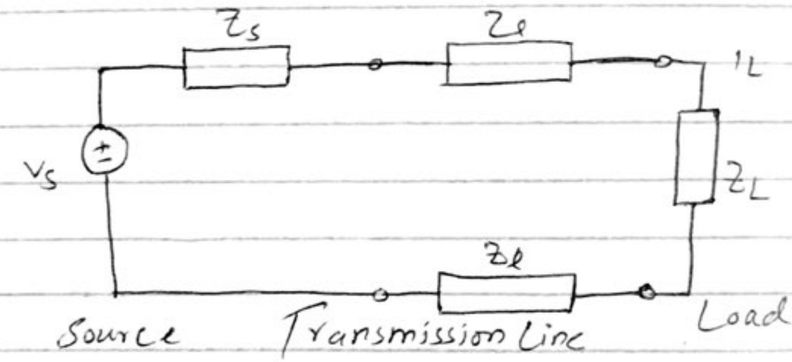
$3V_s = 60$ yields $V_s = 20$

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

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

Q 5g-

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



$$Z = Z_s + 2Z + Z_L$$

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

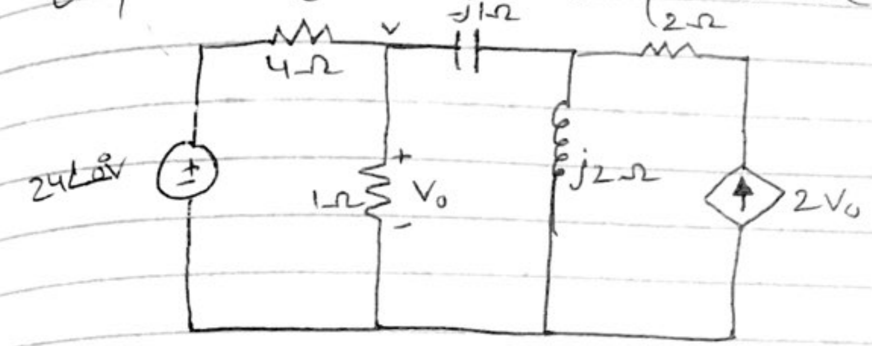
$$Z = 25 + j20$$

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

$$\underline{I_L} = 3.592\angle -38.66^\circ \, A.$$

Q6:-

For the circuit in Fig. 5 find the dependent current source.



Consider the ~~curr~~ circuit as shown

At node 0

$$\frac{24 - V_0}{4} = \frac{V_0}{1} + \frac{V_0 - V_1}{-j}$$

$$24 = (5 + j4)V_0 - j4V_1 \quad \text{—— (1)}$$

At node 1

$$\frac{V_0 - V_1}{-j} + 2V_0 = \frac{V_1}{j2}$$

$$V_1 = (2 - j4)V_0 \quad \text{—— (2)}$$

Substracting (2) into (1)

$24 = (5 + j4 - j8 - 16) v_0$

$v_0 = \frac{-24}{11 + j4}$, $v_1 = \frac{(-24)(2 - j4)}{11 + j4}$

voltage across the dependend source is

$v_2 = v_1 + (2)(2v_0) = v_1 + 4v_0$

$v_2 = \frac{-24}{11 + j4} - (2 - j4 + 4) = \frac{(-24)(6 - j4)}{11 + j4}$

$\delta = v_2 I = v_2 (2v_0)$

$\delta = \frac{(-24)(6 - j4)}{11 + j4} - \frac{-48}{11 - j4} = \left(\frac{1152}{137}\right)(6 - j4)$

$\delta = (50.45 - j33.64) VA$

Q7:-
A balance Y-Load to a 60Hz three Phase ...... Phase draw 5 KW.

(a) determine the load independenen
(b) Find I_a I_b & I_c

(a)
$|V_{ab}| = \sqrt{3}V_p = 240 \rightarrow V_p = \frac{240}{\sqrt{3}} = 138.56$

$V = V_p \angle -30^0$

$pf = 0.5 = \cos\theta$

$P = S\cos\theta \Rightarrow S = \frac{P}{\cos\theta} = \frac{5}{0.5} = 10 \, KVA$

$Q = S\sin\theta = 10\sin 60 = 8.66$

$S_p = 5 + j8.66 \, KVA$

But
$S_p = \frac{V_p^2}{Z_p} \rightarrow Z_p = \frac{V^2_p}{S_p} = \frac{138.56^2}{(5+j8.66)\times 10^2}$

(B)

$$I_a = \frac{v}{Z_r} = \frac{138.56 \angle -30^\circ}{0.96 + j1.6627} = 72.17 \angle 90^\circ A$$

$$I_b = I_0 \angle -120^\circ = 72.17 \angle -210^\circ A$$

$$I_c = I_a \angle +120 = 72.17 \angle 30^\circ A.$$