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Module	4th
Subject	Electrical Network Analysis
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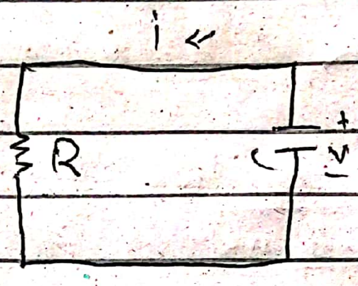
Assingment	**Sessional**

Q No 1 :-

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.

Ans:



step 1 :-

(A)

$$\tau = RC = \frac{1}{4}$$

$$\Rightarrow i = C\frac{dv}{dt}$$

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

$$\Rightarrow C = 5\,mF$$

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

step 2

(B)

$$\tau = RC = \frac{1}{4} = 0.25\,s$$

step 3 :-

(C)

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

$$\Rightarrow \frac{1}{2}(5\times 10^{-3})(100)$$

$$\Rightarrow 250\,mJ$$

step 4 :-

(ii) $w_R = \frac{1}{2} \times \frac{1}{2} C V_0^2$

$\Rightarrow \frac{1}{2} C V_0^2 (1 - e^{-2t})$

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

OR

$e^{8t_0} = 2$

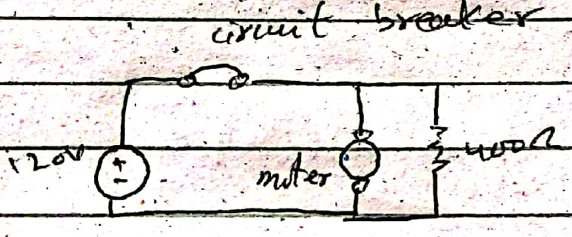
$\therefore$

$t_0 = 1/8 \ln(2)$

$\Rightarrow$ **86.6 ms**

Q2 :- A 120V dc generator energize a motor whose coil -------

Ans :-



step 1 :-

Let The inducter current for $t<0$

$i(0) = \frac{120}{100} = \frac{12}{10}$

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

For $t>0$ we have an RL - circuit

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

$\Rightarrow \frac{50}{500} = \frac{5}{50}$

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

$\therefore\ i(\infty) = 0$

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

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

At $t = 100ms = 0.1s$

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

~~which~~ which is The same as The current Through The resistor.

step 02:

$T = R_c m s = 60\,\mu s$

An integrator

$T < 0.1\ \tau = 6\,\mu s$

$\boxed{T_{max} = 6\,\mu s}$

Q No 3:- The Response of series RLC circuit -------

Ans:

step 1:

series RLC circuit.

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

$v(t) = V_1 + A_1e^{s_1t} + Ae^{s_2t}\quad [\alpha > \omega]$

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

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

campasing These equ --- we get

$V_s = 30$

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

$s_1 = -20 \; ; \quad S_2 = -1 \rightarrow (a)$

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

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

step 2 :-

Now Equ (a) & (b)

$s_1 = -\alpha + \sqrt{\alpha^2 + \omega_0^2}$ And $S_2 = -\alpha - \sqrt{\alpha^2 - \omega_0^2}$

$s_1 + S_2 = -2\alpha$ & $S_1 S_2 = \omega_0^2$

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

$\Rightarrow -30 = -2\alpha$

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

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

step 03 :-

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

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

(OR)

$[s_1 = s_1' , \quad S_2 = S_2']$

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

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

using Equ (c) & (d)

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

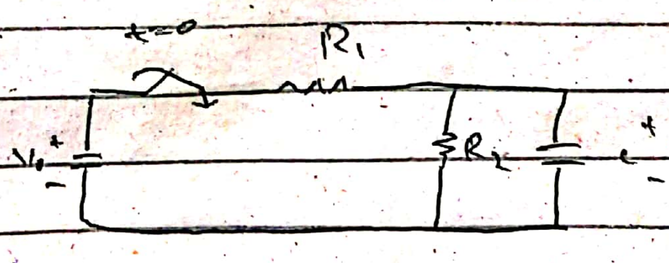
& $R = 30L = 30 \times 25 = 750 \Omega$

$C = 200 \mu F$
$L = 25 H$ } Answer.
$R = 750 \Omega$

Q No 4

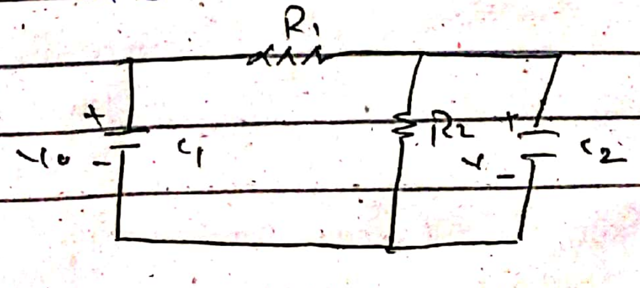
The circuit Fig. 3 is the eectrical analog ------

Ans:-



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

For $t>0$ the circuit is shown below



$$v_0 - v/R_1 = (v/R) + C_2 \frac{dv}{dt}$$

$$v_0 = v(1 + R_1/R_2) + R_1 C_2 \frac{dv}{dt}$$

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

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

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

where

$$3v_s = 60 \text{ yields } v_s = 20$$

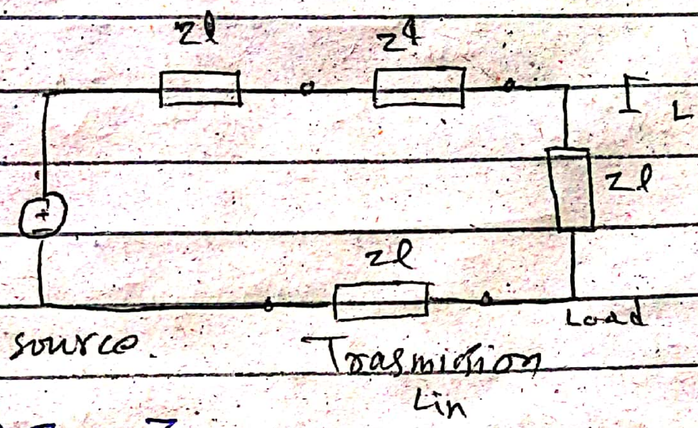
$$v(0) = 0 = 20 + A \text{ or } A = -20$$

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

Q No 5 :

A power transmission system is modeled ——————

Ans :



$Z = Z_a + 2Z + Z_0$

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

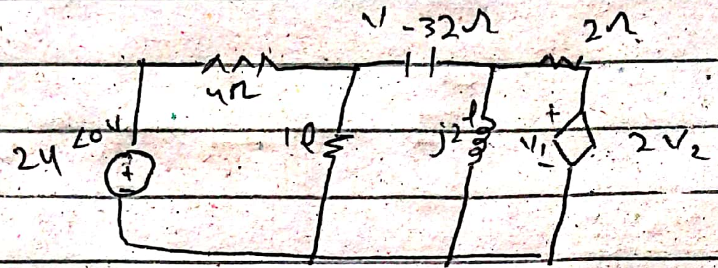
$Z = 25 + j20$

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

$I_L = 3.592 \angle -38.66$ A

Q 6 :- For the circuit in Fig- 5 find the one ------

Ans :-



consider the circuit as show

At nod 0

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

$$24 = (5 + j4)V_0 - j4V_1 \rightarrow (1)$$

At node 1

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

$$V_1 = (2 - j4)V_0 \rightarrow (2)$$

subsituting (2) into (1)

$$24 = (5 + j4 - j8 - 16)V_0$$

$$V_0 = \frac{-24}{11 + j4} \qquad V_1 = \frac{(-24)(2 - j4)}{11 + j4}$$

voltge across The dependent source is,

$$V_2 = V_1 + (2)(2V_0) = V_1 + 4V_0$$

$$V_2 = \frac{-24}{11+4j}\left(2 - j4 *\right) = \frac{(-24)(6-j4)}{11+4j}$$

$$S = \frac{1}{2} V_2 I^* = \frac{1}{2} V_2 (2 V_0^*)$$

$$S = \frac{(-24)(6-j4)}{11+j4} \cdot \frac{-24}{11-j4}$$

$$= \left(\frac{576}{137}\right)(6-j4)$$

$$S = 25.23 - j16.82 \text{ VA}$$

(Q 7) A balanced Y-load to a 60 Hz Three phase ----

Ans.

step of ..

$|V_{ab}| = \sqrt{3} V_p = 240 \rightarrow V_p = \frac{240}{\sqrt{3}}$

$= 138.56$

$V_{an} = V_p \angle -30^\circ$

$Pf = 0.5 = \cos\theta \rightarrow \theta = 60^\circ$

$P = S\cos\theta \rightarrow S = \frac{P}{\cos\theta} = \frac{5}{0.5} = 10 \text{ KVA}$

$Q = S\sin\theta = 10\sin 60 = 8.666$

$S_P = 5 + j8.66 \text{ KVA}$

But.

$S_p = \frac{V_p^2}{Z_p} \rightarrow Z_p = \frac{V_p^2}{S_p} = \frac{138.56^2}{(5 + j8.66) \times 10^3}$

$= 0.96 - j1.663$

$Z_p = 0.96 + j1.663 \, \Omega$