Course Details

Course Tittle :- ENA

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Modul :- 4th Semester.

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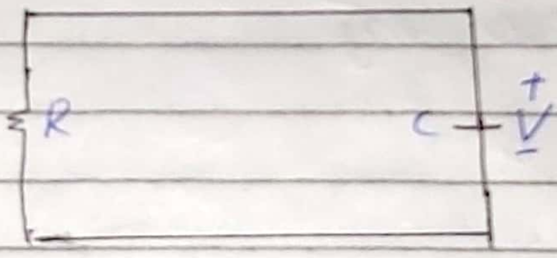
Q1 For the Circuit in Fig 1

if $v = 10e^{-4t}$ & $0.2e^{-4t}$ $t > 0$

(a) Find R & C (b) ... (c) ... (d) ...
50 % of the initial energy.



STEP 1

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

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

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

$\Rightarrow C = 5mF$

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

STEP 2

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

STEP 3

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

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

$\Rightarrow 250 \text{ mJ}$

STEP 4

(D) $W_R = \frac{1}{2} \times \frac{1}{2} CV_0^2$

$\Rightarrow \frac{1}{2} CV_0^2 (1 - e^{-2t_0} = \frac{1}{2}$

OR

$e^{8t_0} = 2$

$\Rightarrow T_0 = \frac{1}{8} (\ln(2))$

$\Rightarrow 86.6 \text{ ms}$

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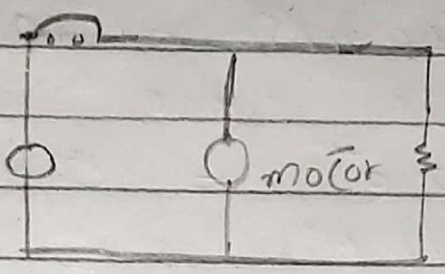
Q2 A 120-v dc generator energize a motor whose coil

circuit breaker



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

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

$$\Rightarrow \frac{5\cancel{0}}{50\cancel{0}} \Rightarrow \frac{5}{50}$$

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

$$i(\infty) = 0$$

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

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

At $t = 100 ms = 0.1 s$

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

which the same as the current through the resistor

(B) $\tau = RC ms = 60 \mu s$

An integrator

$\tau_c = 0.1 \tau = 6 \mu s$

$T_{max} = 6 \mu s$

$\Rightarrow \alpha = 15$

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

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

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STEP 3

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

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

OR

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

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

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

Using Equ (c) & (d)

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

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

Q3 The Response of RLC Series RLC Circuit Determine
The value of R, L, C.

Series RLC circuit
$V_2(t)$ $30 - 10e^{-20t} + 30e^{-10t}$ 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

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

Comparing these equ... we get

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

$S_1 = -20,\quad S_2 = -10 \rightarrow (a)$

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

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

STEP 2

Now Equ (a) & (b)

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

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

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

$\Rightarrow -30 = -2\alpha$

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

$V_2 = \frac{-24}{11 + j4} \cdot (2 - j4 + 4) = (-24) \frac{(6 - j4)}{11 + j4}$

$S = V_2 I = V_2 (2V_0)$

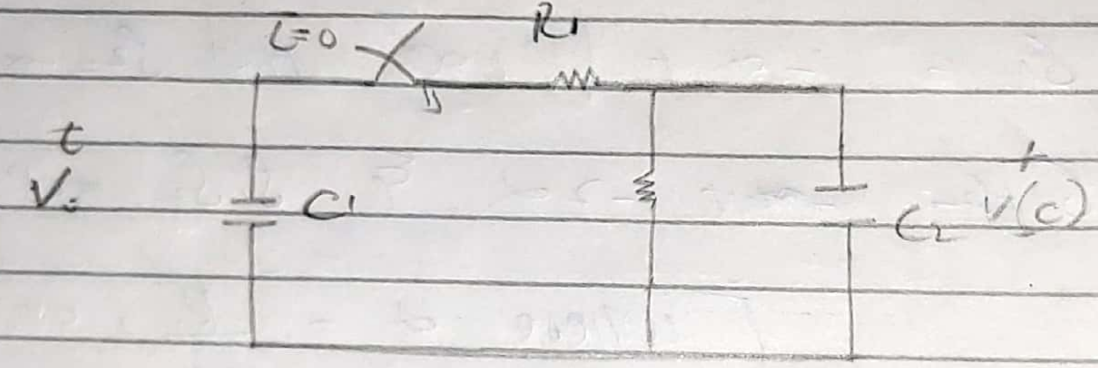
$S = \frac{(-24)(6 - j4)}{11 + j4} = \frac{-48}{11j4} = \left(\frac{1152}{137}\right)(6 - j4)$

$S \; (50.45 - j\, 33.64)$ VA

$v(0) = 2 \quad 0 = 20 + A$ or $A = -20$

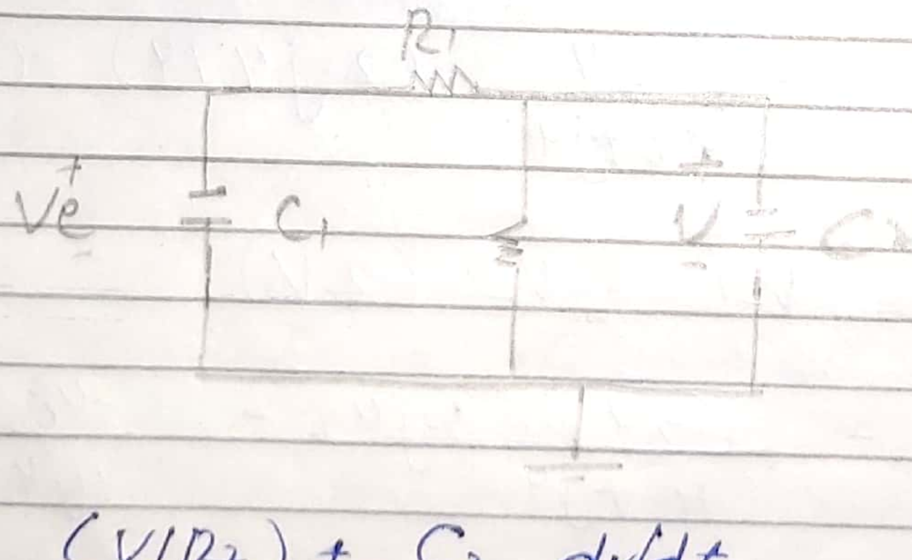
$v(t) = 20 \left(1 - e^{-3t/25}\right) V$

Q4 The circuit in fig. 3 is the electrical analog of body function



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

For $t > 0$ the circuit is shown below



$V_0 - VR = (V/R_2) + C_2\, dv/dt$

$V_0 = v(1 + R_1/R_2) + R_1 C_1\, dv/dt$

$60 = (1 + 5/25) + (5 \times 10^6 \times 5 \times 10^{-6})\, dv/dt$

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

$v(t) = V_3 + [Ae^{-3t/25}]$

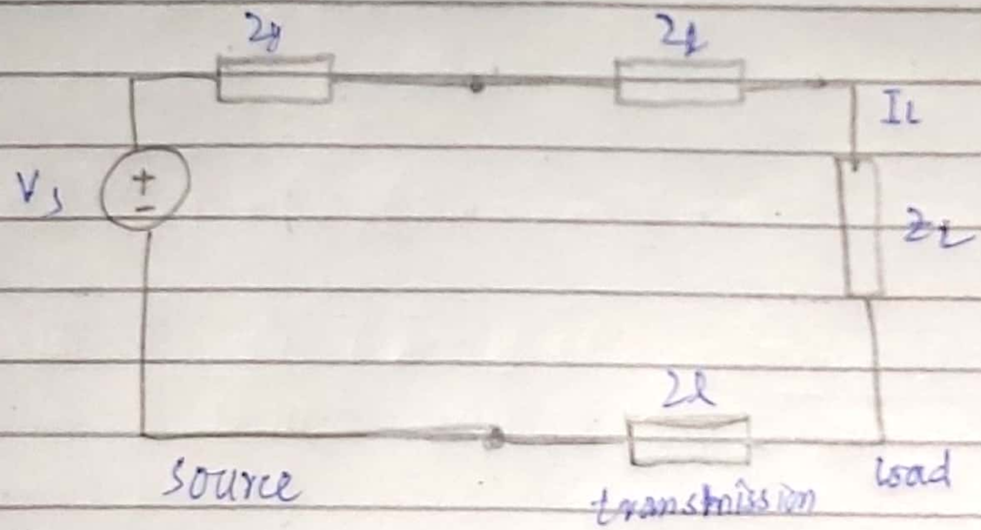
where

$3 V_3 = 60$ yields $V_s = 20$

$$V(0) = 0 = 20 + A = -20$$

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

Q5. A power transmission system is modeled as shown... Find the load current.



$Z = Z_a + 2Z + Z_L$

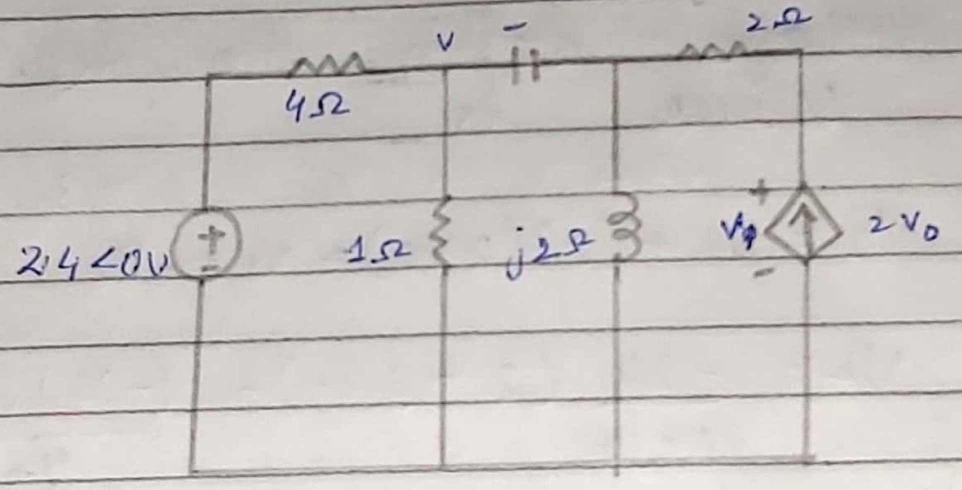
$Z = (1 + 0.8 + 23.2) + j(0.5 + 0.6 + 18.9)$

$Z = 25 + j20$

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

$I_L = 3.59\angle -38.66^\circ$ A.

Q6 :- For the current in Fig. 5 - Find the ave.......?



Consider the circuit as shown

→ At node ①

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

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

→ At node 1

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

$$V_1 = (2 - j4) V_0 \longrightarrow (2).$$

Substituting (2) into (1)

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

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

voltage across the dependent source is

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

$$V_2 = \frac{-24}{11+j4}(2-j4+) = \frac{(-24)(6-j4)}{11+j4}$$

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

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

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

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

Q 7:- A balanced Y-load to a 60 Hz three phase — phase draw 5 KW.

(a) Determine the load impendence

(b) Find I_a I_b & I_c.

→ (a)

$$|V_{ab}| = \sqrt{3} V_p = 240 \longrightarrow V_p = \frac{240}{\sqrt{3}} = 138.56$$

$$V = V_p \angle -30^\circ$$

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

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

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

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

But

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

$$Z_p = 0.96 - j1.663.$$

$$Z_p = 0.96 + j1.6637\ \Omega$$

(b.) → $\bar{I}_a = \frac{V}{Z_r} = \frac{138.56\angle -30^\circ}{6.96+j1.6627} = 72.17\angle -90^\circ A$

$\bar{I}_b = \bar{I}_0 \angle -120 = 72.17\angle -210^\circ A$

$\bar{I}_c = \bar{I}_a \angle +120 = 72.17\angle 30^\circ A.$