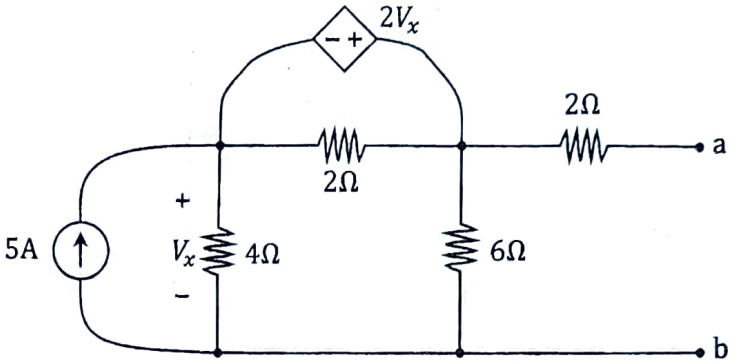
T.C.
KÜTAHYA DUMLUPINAR ÜNİVERSİTESİ
MÜHENDİSLİK FAKÜLTESİ
BİLGİSAYAR MÜHENDİSLİĞİ BÖLÜMÜ
DEVRE TEORİLERİ DERSİ – YAZ OKULU ARA SINAVI

18.07.2019, Perşembe
Saat 13[30]

Not: Sadece 3 soru çözülecektir.
Sorular öğrencide kalabilir.
Süre 45 dakikadır.

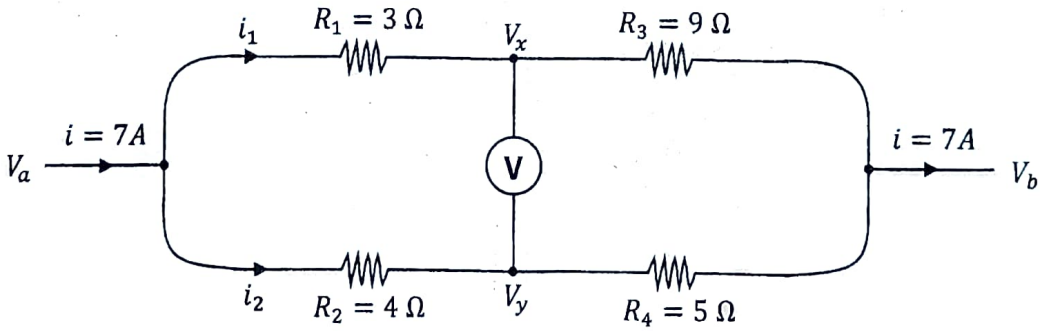
Soru 1

Yanda verilen devrenin $a\,b$ uçları arasındaki Thevenin eşdeğerini bulunuz. Sonra eşdeğer devreye $R_L = 4\,\Omega$ direncini bağlayıp i_L akımını ve V_L gerilimini bulunuz.



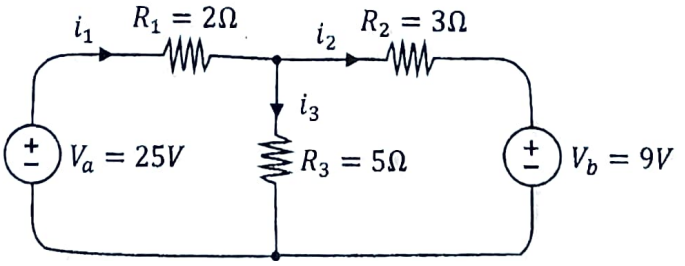
Soru 2

Aşağıda verilen devrede kullanılan voltmetrenin ölçtüğü voltajı bulunuz.



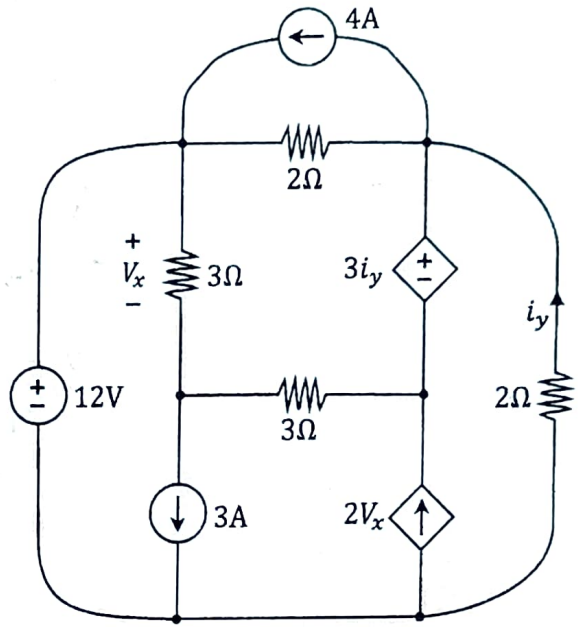
Soru 3

Yanda verilen devreyi çözüp devre elemanları üzerlerindeki akımları, voltajları ve güçleri bulunuz. Toplam tüketilen ve üretilen güçleri bulunuz.



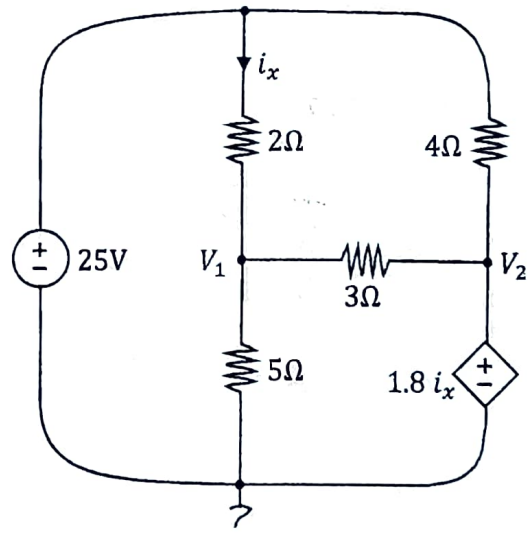
Soru 4

Yanda verilen devreyi Mesh Analiz (K.V.L.) yöntemini kullanarak çözüp V_x gerilimini ve i_y akımını bulunuz.



Soru 5

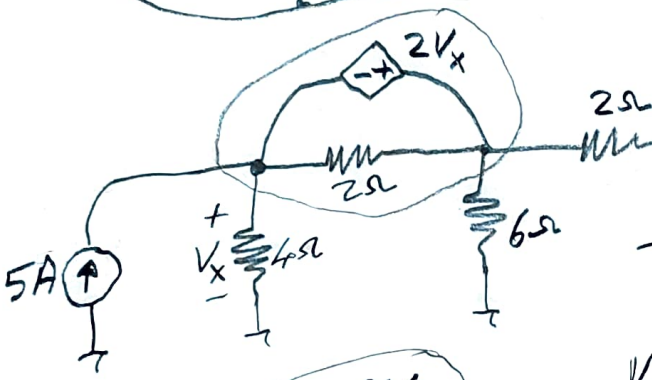
Yanda verilen devreyi Node Analiz (K.C.L.) yöntemini kullanarak çözüp V_1 ve V_2 gerilimlerini bulunuz



Devre Teorileri Dersi Yaz Okulu Ara Sınav 18.07.2019 Perşembe

(1)

Thevenin Eşdeğerini bul. $R_L = 4\Omega$ ise $i_L = ?$, $V_L = ?$



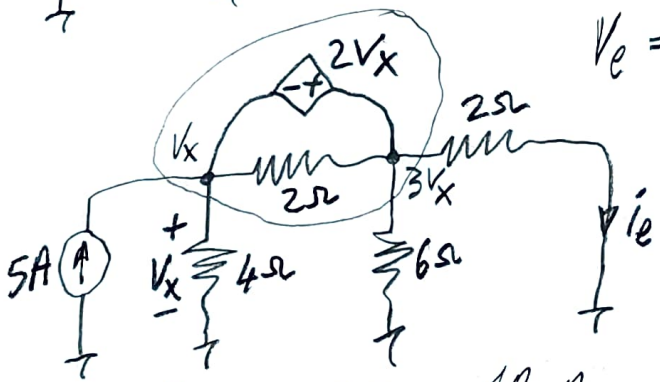
$$-5 + \frac{V_x}{4} + \frac{V_x + 2V_x}{6} = 0$$

4 ile sarp.

$$-20 + V_x + 2V_x = 0$$

$$3V_x = 20 \Rightarrow V_x = \frac{20}{3}\,V$$

$$V_e = V_x + 2V_x = 3V_x = 20V$$



$$-5 + \frac{V_x}{4} + \frac{3V_x}{6} + \frac{3V_x}{2} = 0$$

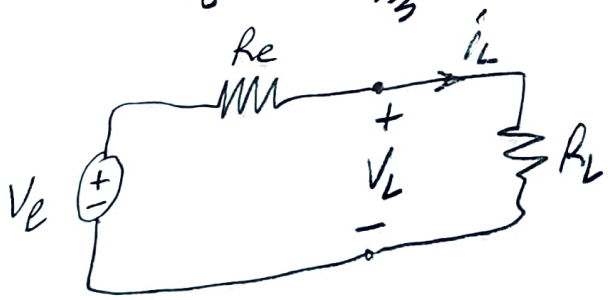
4 ile sarp

$$-20 + V_x + 2V_x + 6V_x = 0$$

$$9V_x = 20 \Rightarrow V_x = \frac{20}{9}\,V$$

$$i_e = \frac{3V_x}{2} = \frac{3}{2}\,\frac{20}{9}\,A = \frac{10}{3}\,A$$

$$R_e = \frac{V_e}{i_e} = \frac{20V}{10/3\,A} = 6\Omega$$

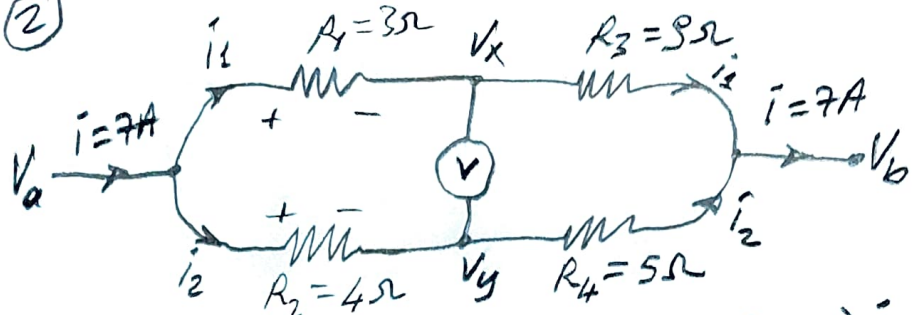


$$i_L = \frac{V_e}{R_e + R_L} = \frac{20V}{6\Omega + 4\Omega} = \frac{20V}{10\Omega}$$

$$= 2A$$

$$V_L = R_L i_L = 4\Omega \times 2A = 8V$$

(2)



Voltmetrenin ölçtüğü voltajı bulunuz.

$V_{ab} = (R_1+R_3)i_1 = (R_2+R_4)i_2 \Rightarrow (3+9)i_1 = (4+5)i_2$

$12i_1 = 9i_2 \Rightarrow i_2 = \frac{4}{3}i_1$

$i = i_1 + i_2 = i_1 + \frac{4}{3}i_1 = \frac{7}{3}i_1 = 7A \Rightarrow i_1 = 3A,\ i_2 = i - i_3 = 7A - 3A = 4A$

$V = V_x - V_y = R_2 i_2 - R_1 i_1 = 4\Omega \times 4A - 3\Omega \times 3A = 16V - 9V = 7V$

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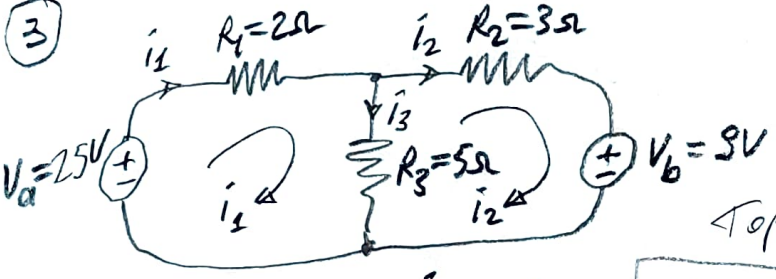
(3)



Devre elemanları üzerindeki akımları, voltajları, güçleri bulunuz. Toplam tüketilen ve üretilen güçleri bulunuz.

$V_a - (R_1+R_3)i_1 + R_3 i_2 = 0 \Rightarrow \boxed{7i_1 - 5i_2 = 25}$ 1. denklem

$R_3 i_1 - (R_2+R_3)i_2 - V_b = 0 \Rightarrow \boxed{5i_1 - 8i_2 = 9}$ 2. denklem

$$\begin{bmatrix} 7 & -5 & 25 \\ 5 & -8 & 9 \end{bmatrix} \sim \begin{bmatrix} 2 & 3 & 16 \\ 5 & -8 & 9 \end{bmatrix} \sim \begin{bmatrix} 1 & 1.5 & 8 \\ 5 & -8 & 9 \end{bmatrix} \sim \begin{bmatrix} 1 & 1.5 & 8 \\ 0 & -15.5 & -31 \end{bmatrix}$$

$$\sim \begin{bmatrix} 1 & 1.5 & 8 \\ 0 & 1 & 2 \end{bmatrix} \sim \begin{bmatrix} 1 & 0 & 5 \\ 0 & 1 & 2 \end{bmatrix}$$

$i_1 = 5A$

$i_2 = 2A$

$i_3 = i_1 - i_2 = 5A - 2A = 3A$

$V_1 = R_1 i_1 = 2\Omega \times 5A = 10V \Rightarrow P_1 = V_1 i_1 = 10V \times 5A = 50W$

$V_2 = R_2 i_2 = 3\Omega \times 2A = 6V \Rightarrow P_2 = V_2 i_2 = 6V \times 2A = 12W$

$V_3 = R_3 V_3 = 5\Omega \times 3A = 15V \Rightarrow P_3 = V_3 i_3 = 15V \times 3A = 45W$

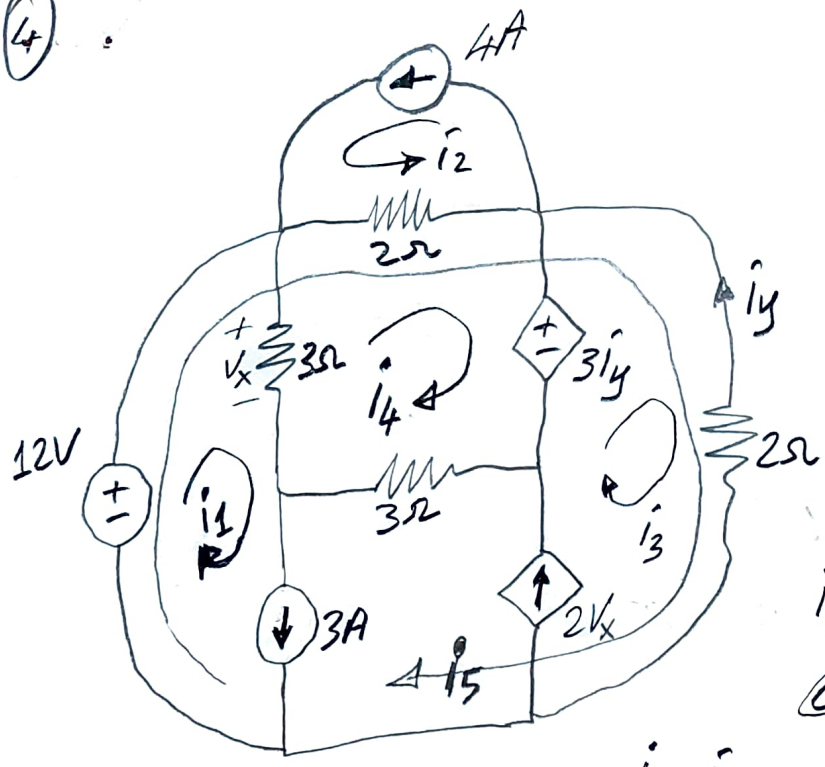
$P_{tük} = P_1 + P_2 + P_3 = 50W + 12W + 45W = 107W$

$P_a = V_a i_1 = 25V \times 5A = 125W$ Üretici

$P_b = V_b i_2 = 9V \times 2A = 18W$ Tüketici

$P_{üret} = P_a - P_b = 125W - 18W = 107W$

(4)



Mesh Analiz (KVL)

$V_x = ?$ $i_y = ?$

$i_1 = 3A$

$i_2 = 4A$

$i_3 = 2V_x$

$i_3 + i_5 = -i_y$

$\hookrightarrow i_5 = -2V_x - i_y$

$i_y - i_4 = \frac{V_x}{3} \Rightarrow i_4 = 3 - \frac{V_x}{3}$

5 gözden sadece 2'si alınır.

$12 - 2(i_2 + i_4 + i_5) + 2i_y = 0$

$12 - 2(4 + 3 - \frac{V_x}{3} - 2V_x - i_y) + 2i_y = 0$

$12 - 14 + \frac{2V_x}{3} + 4V_x + 2i_y + 2i_y = 0 \Rightarrow \boxed{7V_x + 6i_y = 3}$ 1. denklem

$V_x - 2(i_2 + i_4 + i_5) - 3i_y - 3i_4 = 0$

$V_x - 2(4 + 3 - \frac{V_x}{3} - 2V_x - i_y) - 3i_y - 3(3 - \frac{V_x}{3}) = 0$

$V_x - 14 + \frac{2V_x}{3} + 4V_x + 2i_y - 3i_y - 9 + V_x = 0$

$(6 + \frac{2}{3})V_x - i_y = 23$, 3 ile çarp $\Rightarrow \boxed{20V_x - 3i_y = 69}$ 2. denklem

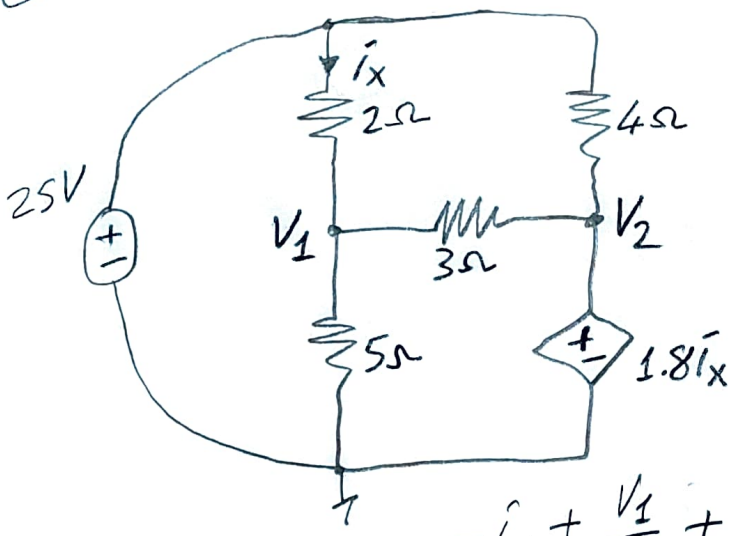
$$\begin{bmatrix} 7 & 6 & 3 \\ 20 & -3 & 69 \end{bmatrix} \sim \begin{bmatrix} 47 & 0 & 141 \\ 20 & -3 & 69 \end{bmatrix} \sim \begin{bmatrix} 1 & 0 & 3 \\ 20 & -3 & 69 \end{bmatrix}$$

$$\sim \begin{bmatrix} 1 & 0 & 3 \\ 0 & -3 & 9 \end{bmatrix} \sim \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & -3 \end{bmatrix}$$

$V_x = 3V$

$i_y = -3A$

(5)



Node Analiz (KCL)

$V_1 = ?$ $V_2 = ?$

$V_1 = 25 - 2i_x$

$V_2 = 1.8i_x$

$-i_x + \frac{V_1}{5} + \frac{V_1 - V_2}{3} = 0$, 15 ile çarp

$-15i_x + 3V_1 + 5V_1 - 5V_2 = 0$

$-15i_x + 8V_1 - 5V_2 = 0$

$-15i_x + 8(25 - 2i_x) - 5(1.8i_x) = 0$

$-15i_x + 200 - 16i_x - 9i_x = 0$

$40i_x = 200 \Longrightarrow i_x = 5A$

$V_1 = 25 - 2i_x = 25V - 2\Omega \times 5A = 25V - 10V = 15V$

$V_2 = 1.8i_x = 1.8\Omega \times 5A = 9V$

T.C.
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BİLGİSAYAR MÜHENDİSLİĞİ BÖLÜMÜ
DEVRE TEORİLERİ DERSİ – YAZ OKULU FİNAL SINAVI

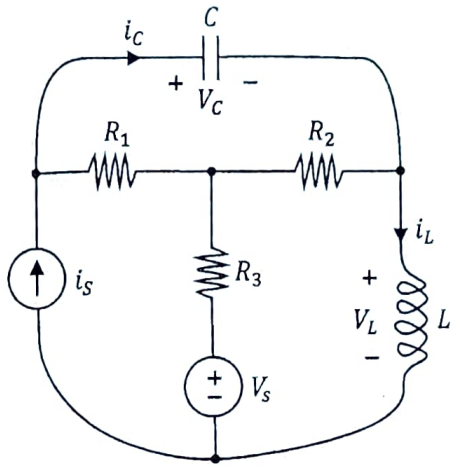
07.08.2019, Çarşamba
Saat 13[30]

Not: Sadece 3 soru çözülecektir.
Sorular öğrencide kalabilir.
Süre 45 dakikadır.

Soru 1

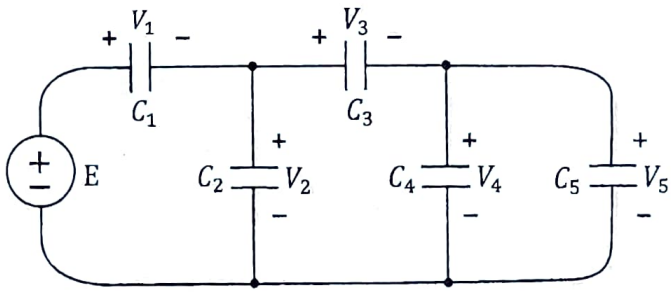
Yanda verilen devrede DC şartlar oluştuğunda üretilen ve tüketilen güçleri bulunuz. Ayrıca kapasitör ve bobinde depolanan enerjiyi bulunuz.

$V_S = 13\,V$, $i_S = 2\,A$, $C = 16\,mF$, $L = 4\,H$, $R_1 = 8\,\Omega$, $R_2 = 3\,\Omega$, $R_3 = 4\,\Omega$ olsun.



Soru 2

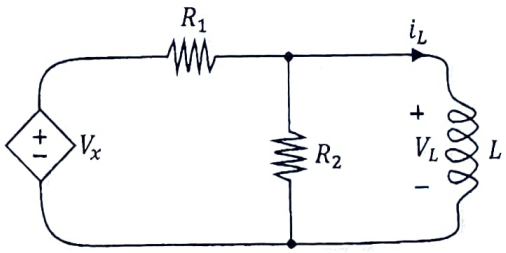
$C_1 = 30\,mF$, $C_2 = 24\,mF$, $C_3 = 30\,mF$, $C_4 = 20\,mF$, $C_5 = 50\,mF$, $E = 25\,V$ olsun. Devrenin eşdeğer kapasidansını ve her bir kapasitör üzerindeki yük ve voltajları bulunuz.



Soru 3

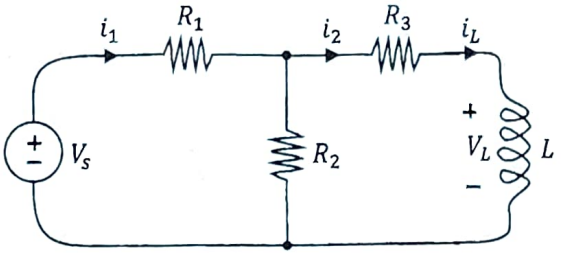
Yanda verilen devreyi Mesh Analiz (K.V.L.) yöntemiyle çözüp diferansiyel denklemini çıkarınız. $i_L(t)$, $V_L(t)$ ve durulma zamanını bulunuz.

$V_x(t) = 15 - 7\,i_L(t)$, $i_L(0^+) = 5\,A$, $R_1 = 3\,\Omega$, $R_2 = 2\,\Omega$, $L = 8\,H$ olsun.



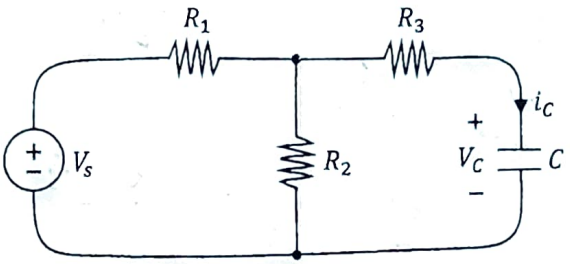
Soru 4

Yanda verilen devreyi Mesh Analiz (K.V.L.) yöntemi ile çözüp diferansiyel denklemini çıkarınız. $i_L(t)$, $V_L(t)$ ve durulma zamanını bulunuz. $V_S = 30\,V$, $i_L(0^+) = 1\,A$, $R_1 = 3\,\Omega$, $R_2 = 6\,\Omega$, $R_3 = 3\,\Omega$, $L = 2\,H$ olsun.



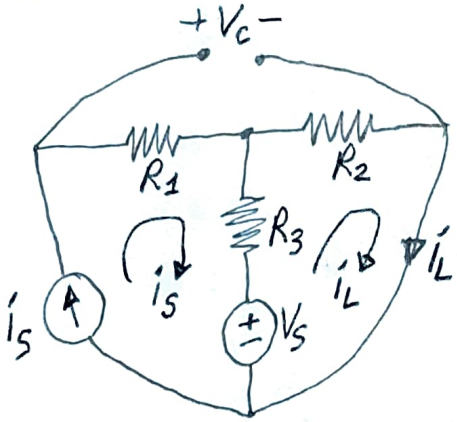
Soru 5

Yanda verilen devreyi Node Analiz (K.C.L.) yöntemi ile çözüp diferansiyel denklemini çıkarınız. $V_C(t)$, $i_C(t)$ ve durulma zamanını bulunuz. $V_S = 27\,V$, $V_C(0^+) = 0\,V$, $R_1 = 3\,\Omega$, $R_2 = 6\,\Omega$, $R_3 = 4\,\Omega$, $C = 0.5\,F$ olsun.



Devre Teorileri Dersi Yaz Okulu Final Sınavı Çözümleri 07.08.2019 13 30

(1)



$V_S = 13V$, $i_S = 2A$, $C = 16mF$
$L = 4H$, $R_1 = 8\Omega$, $R_2 = 3\Omega$, $R_3 = 4\Omega$

$i_S = 2A$
$V_S + R_3 i_S - (R_2 + R_3) i_L = 0$
$13 + 4 \times 2 - 7 i_L = 0 \Rightarrow i_L = 3A$

$V_C = R_1 i_S + R_2 i_L = 8\Omega \times 2A + 3\Omega \times 3A = 16V + 9V = 25V$
$P_{iS} = V_C i_S = 25V \times 2A = 50W$
$P_{VS} = V_S (i_L - i_S) = 13V \times (3A - 2A) = 13W$
$P_{üret} = P_{iS} + P_{VS} = 50W + 13W = 63W$

$P_1 = R_1 i_S^2 = 8\Omega \times (2A)^2 = 32W$
$P_2 = R_2 i_L^2 = 3\Omega \times (3A)^2 = 27W$
$P_3 = R_3 (i_L - i_S)^2 = 4\Omega \times (3A - 2A)^2 = 4W$
$P_{tük} = P_1 + P_2 + P_3 = 32W + 27W + 4W = 63W$

$W_C = \frac{1}{2} C V_C^2 = \frac{1}{2} \times 16mF \times (25V)^2 = 5J$
$W_L = \frac{1}{2} L i_L^2 = \frac{1}{2} \times 4H \times (3A)^2 = 18W$

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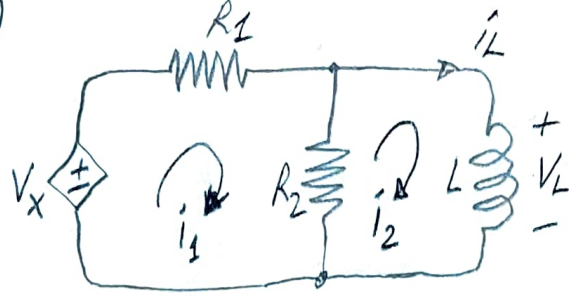
(2) $C_e = C_1 \$ (C_2 + C_3 \$ (C_4 + C_5))$
$= 30mF \$ (24mF + 30mF \$ (20mF + 50mF))$
$= 30mF \$ (24mF + 30mF \$ 70mF)$
$= 30mF \$ (24mF + 21mF) = 30mF \$ 45mF = 18mF$

$Q = C_e E = 18mF \times 25V = 450mC$
$Q_1 = Q = 450mC$, $V_1 = Q_1 / C_1 = \frac{450mC}{30mF} = 15V$
$V_2 = E - V_1 = 25V - 15V = 10V$
$Q_2 = C_2 V_2 = 24mF \times 10V = 240mC$
$Q_3 = Q_1 - Q_2 = 450mC - 240mC = 210mC$
$V_3 = Q_3 / C_3 = 210mC / 30mF = 7V$
$V_4 = V_5 = V_2 - V_3 = 10V - 7V = 3V$
$Q_4 = C_4 V_4 = 20mF \times 3V = 60mC$, $Q_5 = C_5 V_5 = 50mF \times 3V = 150mC$

(3)



$V_x(t) = 15 - 7i_L(t)$, $i_L(0^+) = 5A$

$R_1 = 3\Omega$, $R_2 = 2\Omega$, $L = 8H$

$i_L(t) = ?$ $V_L(t) = ?$

$V_x - (R_1+R_2)i_1 + R_2 i_2 = 0 \Rightarrow 15 - 7i_L - 5i_1 + 2i_L = 0 \Rightarrow i_1 = 3 - i_L$

$R_2(i_1 - i_2) - L\frac{di_L}{dt} = 0 \Rightarrow 2(3 - i_L - i_L) - 8\frac{di_L}{dt} \Rightarrow \frac{di_L}{dt} + 0.5i_L = 0.75$ Dif. Denklemi

$\frac{di_L(\infty)}{dt} = 0 \Rightarrow i_L(\infty) = \frac{0.75}{0.5}A = 1.5A$

$i_L(t) = Ae^{-0.5t} + B$, $t \geq 0$

$i_L(0^+) = A + B = 5 \Rightarrow A = 3.5$

$i_L(\infty) = B = 1.5$

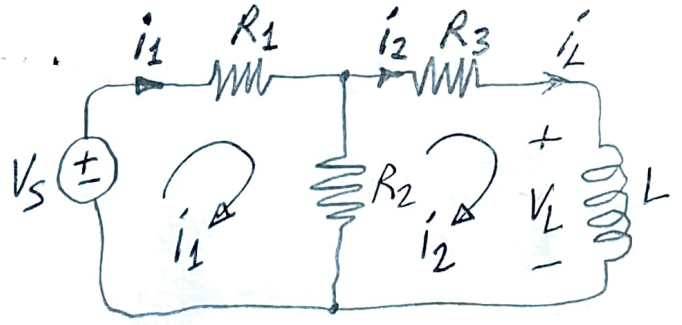
$i_L(t) = 3.5e^{-0.5t} + 1.5$, $t \geq 0$

$V_L(t) = L\frac{di_L}{dt} = 8 \times 3.5 \times (-0.5)e^{-0.5t} = -14e^{-0.5t}$, $t \geq 0$

$\tau = \frac{1}{0.5}sn = 2sn$

Durulma Zamanı $= 5\tau = 5 \times 2sn = 10sn$

(4)



$V_S = 30V$, $i_L(0^+) = 1A$

$R_1 = 3\Omega$, $R_2 = 6\Omega$, $R_3 = 3\Omega$

$L = 2H$, $i_L(t) = ?$, $V_L(t) = ?$

Durulma Zamanı $= ?$

$$V_S - (R_1+R_2)i_1 + R_2 i_2 = 0$$

$$V_S - 9i_1 + 6i_2 = 0$$

$$30 - 9i_1 + 6i_2 = 0$$

$$10 - 3i_1 + 2i_L = 0$$

$$i_1 = \frac{10 + 2i_L}{3}$$

$$R_2 i_1 - (R_2+R_3)i_2 - L\frac{di_L}{dt} = 0$$

$$6i_1 - 9i_L - 2\frac{di_L}{dt} = 0$$

$$6\frac{10+2i_L}{3} - 9i_L - 2\frac{di_L}{dt} = 0$$

$$\frac{di_L}{dt} + 2.5i_L = 10 \quad \text{Dif. Denklem}$$

$\frac{di_L}{dt}(\infty) = 0$ olduğundan $i_L(\infty) = \frac{10}{2.5}A = 4A$

$$i_L(t) = Ae^{-2.5t} + B, \quad t \geq 0$$

$$i_L(0^+) = A + B = 1 \Rightarrow A = -3$$

$$i_L(\infty) = B = 4$$

$$i_L(t) = 4 - 3e^{-2.5t}, \quad t \geq 0$$

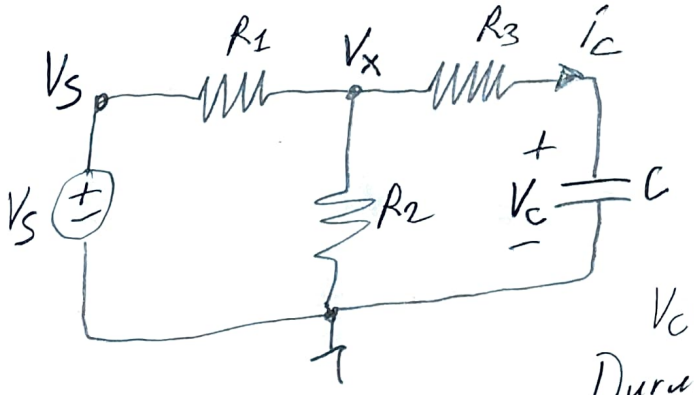
$$V_L(t) = L\frac{di_L}{dt} = 2 \times (-3) \times (-2.5)e^{-2.5t}$$

$$= 15e^{-2.5t}, \quad t \geq 0$$

$$\tau = \frac{1}{2.5} sn = 0.4 sn$$

Durulma Zamanı $= 5\tau = 5 \times 0.4 sn = 2 sn$

(5)



$V_s = 27V$, $V_c(0^+) = 0V$ ...

$R_1 = 3\Omega$, $R_2 = 6\Omega$

$R_3 = 4\Omega$, $C = 0.5F$

$V_c(t) = ?$, $i_c(t) = ?$

Durulma Zamanı $= ?$

$$\frac{V_x - V_s}{R_1} + \frac{V_x}{R_2} + \frac{V_x - V_c}{R_3} = 0$$

$$\frac{V_x - 27}{3} + \frac{V_x}{6} + \frac{V_x - V_c}{4} = 0 \text{ , 12 ile çarp.}$$

$$4V_x - 108 + 2V_x + 3V_x - 3V_c = 0$$

$$9V_x = 108 + 3V_c \Rightarrow V_x = 12 + V_c/3$$

$$i_c = C\frac{dV_c}{dt} = \frac{V_x - V_c}{R_3} \Rightarrow R_3 C\frac{dV_c}{dt} + V_c - V_x = 0$$

$$4 \times 0.5\frac{dV_c}{dt} + V_c - 12 - V_c/3 = 0$$

$$\boxed{\frac{dV_c}{dt} + \frac{1}{3}V_c = 6}$$ Dif. Denklemi

$\frac{dV_c}{dt}(\infty) = 0$ olduğundan $V_c(\infty) = \frac{6}{1/3}V = 18V$

$$V_c(t) = Ae^{-t/3} + B \text{ , } t \geq 0$$

$$V_c(0^+) = A + B = 0 \Rightarrow A = -18$$

$$V_c(\infty) = B = 18$$

$$V_c(t) = 18\left(1 - e^{-t/3}\right) \text{ , } t \geq 0$$

$$i_c(t) = C\frac{dV_c}{dt} = 0.5 \times 18 \times (-1)(-1/3)e^{-t/3}$$

$$= 3e^{-t/3} \text{ , } t \geq 0$$

$\tau = 3$ sn $\Rightarrow$ Durulma Zamanı $= 5\tau = 5 \times 3$sn

$= 15$ sn