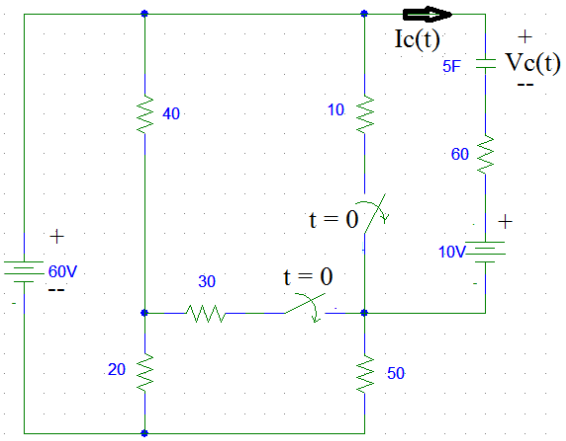
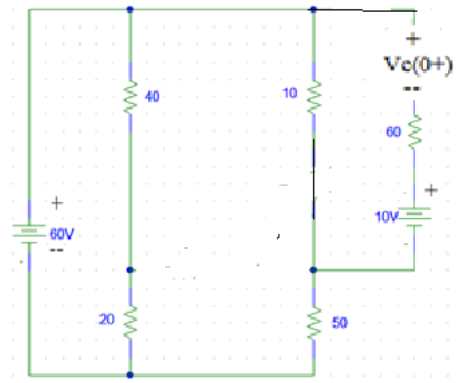
Devre Analizi Bütünleme Sınavı 25-01-2023

İsim : No: İmza:



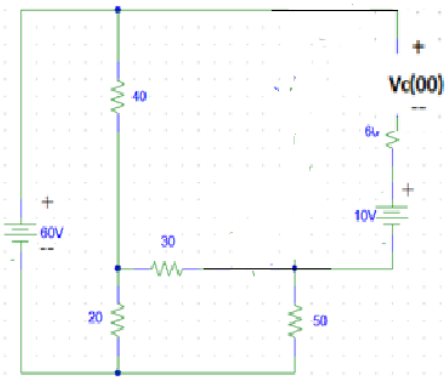
S-1)Şekilde verilen devrede anahtar t = 0 anında kapatılıyor.

t > 0 için Vc(t) ve Ic(t)' yi bulunuz.



$$+Vc(0-) + 10 - \frac{60}{10+50}x10 = 0$$

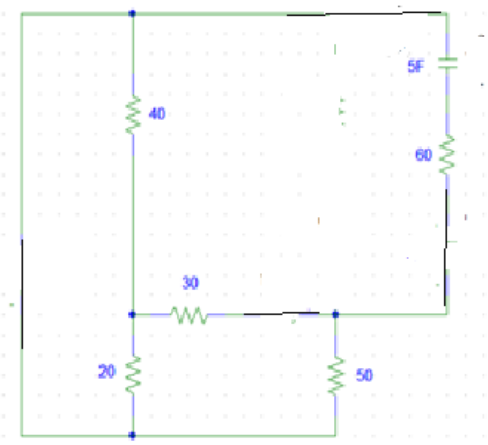
$$Vc(0-) = 0 = Vc(0+)$$



$$\frac{60}{\frac{80\times 20}{80+28}}x40 + \frac{60}{\frac{80\times 20}{80+28}}x\frac{20}{20+30+50}x30 - Vc(\infty) = 0$$

$$42{,}85714 + 6{,}42817 - 10 = Vc(\infty) \qquad Vc(\infty) = 39{,}2857V$$

Zaman sabiti $\tau = R_{eş}xCR_{eş} => R_{eş=}$ (2. durumda selften görülen eşdeğer direnç, gerilim kaynağı kısa devre, akım kaynağı açık devre yapılarak bulunur.)



$$Reş = \frac{\left(\frac{40\times20}{40+20}+30\right)\times50}{\left(\frac{40\times20}{40+20}+30\right)+50} + 60) = 83{,}214$$

$\tau = R_{eş}xC=83{,}214x5=416$

$Vc(t)=Ae^{-t/\tau}+Vc(\infty)$

$Vc(t)=Ae^{-t/416}+39{,}2857$

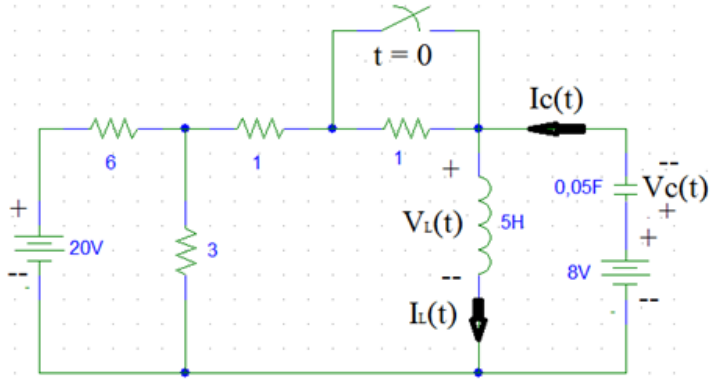
t =0 için Vc(0+)=0V

0=A.1+39,2857 A=-39,2857

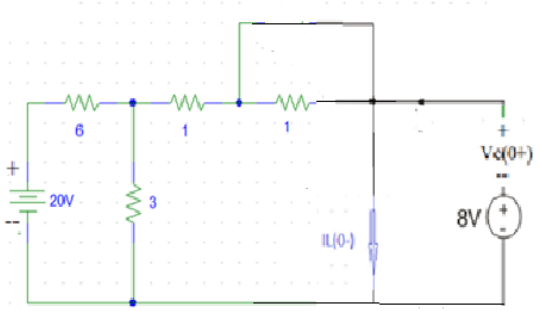
$Vc(t)= -39{,}2857xe^{-t/416} + 39{,}2857$

$Ic(t) = C\frac{dvc}{dt} = 5x(-\frac{1}{416})x(-39{,}2857)xe^{-t/416}$

$Ic(t) = 0{,}472xe^{-t/416}$



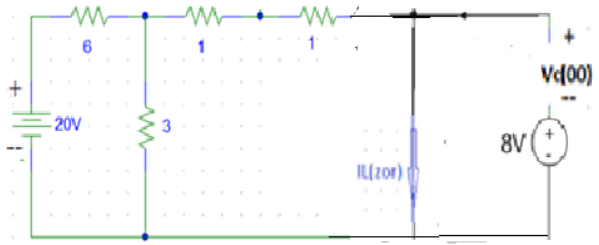
S-2)Yukarıda verilen devrede t = 0 anında açılıyor. t > 0 için IL(t) ve VL(t)'yi yada Vc(t) ve Ic(t)' yi bulunuz.



$$I_L(0^-) = \frac{6,66666}{2+1} = 2.222A = I_L(0^+)$$

$$-V_c(0^-) + 8 = 0$$

$$V_c(0^-) = 8 = V_c(0^+)$$



$$I_L(\infty) = \frac{6,66666}{2+1} = 2.222A$$

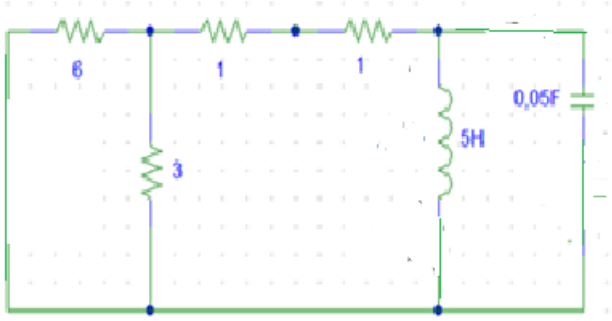
$$-V_c(\infty) + 8 = 0$$

$$V_c(\infty) = 8V$$

$V_{L1}(0^+) = 0$ $V_{L2}(0^+) = 0$ $V_{L3}(0^+) = 0$ $V_L(0^+)$=0+0+0=0

$I_{C1}(0^+) = 1,666A$ $I_{C2}(0^+) = -2,222A$ $I_{C3}(0^+) = 0A$

$I_C(0^+) = 1,666 - 2,222 + 0 = -0,555A$



$\frac{1}{4}+\frac{1}{r.5}+\frac{1}{\frac{1}{\frac{r.1}{20}}}=0$

$\frac{1}{4}+\frac{1}{r.5}+\frac{r}{20}=0$ $\frac{\frac{1}{4}}{5.r}+\frac{1}{\frac{r.5}{4}}+\frac{r}{\frac{20}{r}}=0$ $r^2+.5.r+4=0$

$$r_1,r_2=\frac{-b\mp\sqrt{b^2-4.a.c}}{2.a}=\frac{-5\mp\sqrt{5^2-4.1.4}}{2x1}=\frac{-5\mp\sqrt{25-16}}{2}=\frac{-5\mp3}{2}$$

$r_1=-1$ $r_2=-4$ $(r_1+1).(r_2+4)=0$

$I_L(t)=A.e^{r1.t}+B.e^{r2.t}+I_L(\infty)$

$I_L(t)=A.e^{-4.t}+B.e^{-1.t}+1{,}6666$

t = 0 için $I_L(0^+)=2{,}222=A.1+B.1+1{,}6666$

$A+B=0{,}555$

$4.A+4.B=2{,}222$

$V_L(t)=L.\frac{d_{\text{IL}}}{\text{dt}}=5.(-4.A.e^{-4.t}-1.B.e^{-1.t})$

t = 0 için $V_L(0^+)=0=5.\big((-4).A.1+(-1).B.1\big)$

$-4.A-1.B=0$

$4.A+4.B=2{,}222$

$3.B=2{,}222$ $B=0{,}74074$

$A+B=0,,555$ $A+0{,}74074=0,,555$ A=-0,1852

$I_L(t)=A.e^{r1.t}+B.e^{r2.t}+I_L(\infty)$

$I_L(t)=-0{,}1852.e^{-4.t}+0{,}7474.e^{-1.t}+1{,}666$

$V_L(t)=L.\frac{d_{\text{IL}}}{\text{dt}}=5.(-4.(-0{,}1852.e^{-4.t}-1.0{,}74074.e^{-1.t})$

$V_L(t)=3{,}7.e^{-4.t}-3{,}7e^{-1.t}$

s DOMENİ ÇÖZÜMÜ

$$\begin{vmatrix} 5s+4 & -4 \\ -4 & \frac{20}{s}+4 \end{vmatrix} \begin{vmatrix} I_{L(s)} \\ I_{C(s)} \end{vmatrix} = \begin{vmatrix} 11{,}111+\frac{6{,}66}{s} \\ -\frac{6{,}666}{s} \end{vmatrix}$$

$$I_L(s) = \frac{\begin{bmatrix} 11{,}111+\frac{6{,}666}{s} & -4 \\ -\frac{6{,}666}{s} & \frac{20}{s}+4 \end{bmatrix}}{\begin{bmatrix} 5s+4 & -4 \\ -4 & \frac{20}{s}+4 \end{bmatrix}} == \frac{\frac{222{,}22}{s}+44{,}444+\frac{133{,}333}{s^2}+\frac{26{,}666}{s}-\frac{26{,}666}{s}}{100+20s+\frac{80}{s}+16-16}$$

$$= \frac{\frac{222{,}22}{s}+44{,}444+\frac{133{,}333}{s^2}}{100+20s+\frac{80}{s}} = \frac{222{,}22s+44{,}444s^2+133{,}33}{s.(100s+20s^2+80}$$

$$= \frac{44{,}444s^2+222{,}22s+133{,}33}{s.(20s^2+100s+80)} = \frac{222{,}22s+44{,}444s^2+133{,}33}{s.(100s+20s^2+80}$$

$$= \frac{2{,}222s^2+11{,}111s+6{,}6666}{s.(s+4).(s+1)} \qquad = \frac{A}{s}+\frac{B}{(s+4)}+\frac{C}{(s+1)}$$

$$s^2(A+B+C)+s(5A+B+4C)+4A$$

$$\mathbf{A} = \frac{6{,}666}{4} = 1{,}666 \qquad A+B+C = 2{,}2222$$

$$B+C = 2{,}2222-1{,}6666 = 0{,}55555$$

$$(5A+B+4C) = 11{,}111 \qquad (5x1{,}666+B+4C) = 11{,}111$$

$$(B+4C) = 11{,}111-8{,}333 = 2{,}777$$

$$+B+4C = 2{,}777$$

$$-B-C = -0{,}55555 \qquad 3C = 2{,}222 \qquad C = 0{,}7407$$

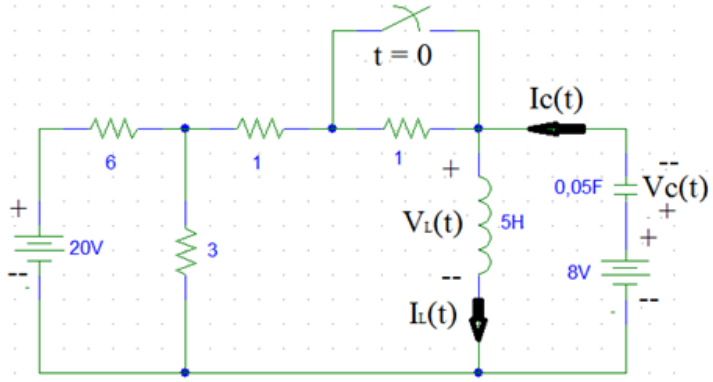
$$+B+4x(0{,}7407 = 2{,}777 \qquad B = -0{,}1871$$

$$I_L(s) = \frac{A}{s}+\frac{B}{(s+4)}+\frac{C}{(s+1)}$$

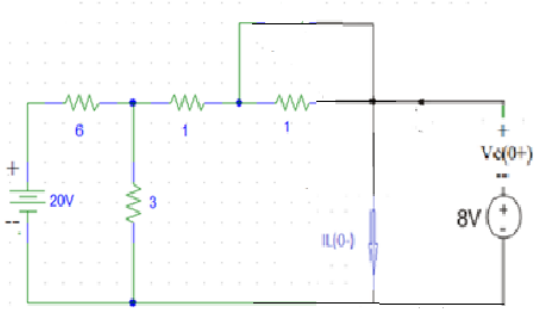
$$I_L(s) = \frac{1{,}6666}{s}-\frac{0{,}1851}{(s+4)}+\frac{0{,}7047}{(s+1)}$$

$$I_L(t) = 1{,}666-0{,}1871.e^{-4.t}+0{,}7047.e^{-1.t}$$

$$V_L(t) = L.\frac{d_{iL}}{dt} = 5.(-4.(-0{,}1852.e^{-4.t}-1.0{,}74074.e^{-1.t}) = 3{,}7.e^{-4.t}-3{,}7e^{-1.t}$$



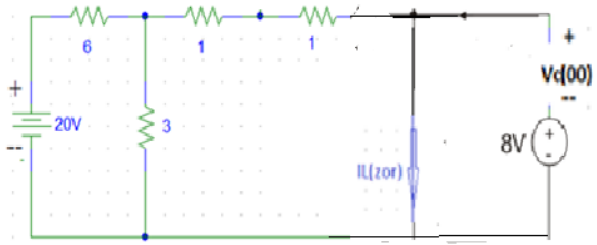
S-2)Yukarıda verilen devrede t = 0 anında açılıyor. t > 0 için IL(t) ve VL(t)'yi yada Vc(t) ve Ic(t)' yi bulunuz.



$$I_L(0^-) = \frac{6,66666}{2+1} = 2.222A = I_L(0^+)$$

$$-V_c(0^-) + 8 = 0$$

$$V_c(0^-) = 8 = V_c(0^+)$$



$$I_L(\infty) = \frac{6,66666}{2+1} = 2.222A$$

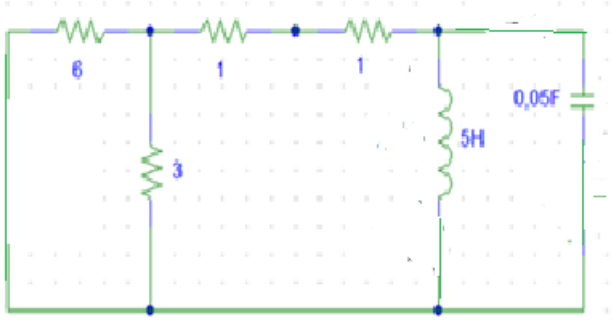
$$-V_c(\infty) + 8 = 0$$

$$V_c(\infty) = 8V$$

$V_{L1}(0^+) = 0$ $V_{L2}(0^+) = 0$ $V_{L3}(0^+) = 0$ $V_L(0^+)$=0+0+0=0

$I_{C1}(0^+) = 1,666A$ $I_{C2}(0^+) = -2,222A$ $I_{C3}(0^+) = 0A$

$I_C(0^+) = 1,666 - 2,222 + 0 = -0,555A$



$$\frac{1}{4}+\frac{1}{r.5}+\frac{1}{\frac{1}{\frac{r.1}{20}}}=0$$

$$\frac{1}{4}+\frac{1}{r.5}+\frac{r}{20}=0 \qquad \frac{1}{\frac{4}{5.r}}+\frac{1}{\frac{r.5}{4}}+\frac{r}{\frac{20}{r}}=0 \qquad r^2+.5.r+4=0$$

$$r_1,r_2=\frac{-b\mp\sqrt{b^2-4.a.c}}{2.a}=\frac{-5\mp\sqrt{5^2-4.1.4}}{2x1}=\frac{-5\mp\sqrt{25-16}}{2}=\frac{-5\mp 3}{2}$$

$$r_1=-1 \quad r_2=-4 \quad (r_1+1).(r_2+4)=0$$

$$V_c(t)=A.e^{-r1.t}+B.e^{-r2.t}+V_c(\infty)$$

$$V_c(t)=A.e^{-4.t}+B.e^{-1.t}+8$$

t = 0 için $V_c(0^+)=8=A.1+B.1+8 \qquad A+B=0$

$$I_C(t)=C.\frac{d_{\mathrm{VC}}}{\mathrm{dt}}=0{,}05.(-4.A.e^{-4.t}-1.B.e^{-1.t})$$

t = 0 için $I_c(0^+)=-0{,}5555=0.05.\big((-4).A.1+(-1).B.1\big)$

$$-4.A-B=-11{,}111$$

$$A+B=0$$

-3.A=-11,111

A=3,705666 B=-3,705666

$$V_c(t)=A.e^{-4.t}+B.e^{-1.t}+8$$

$$V_c(t)=3{,}705666.e^{-4.t}-3{,}705666.e^{-1.t}+8$$

$$I_C(t)=C.\frac{d_{\mathrm{VC}}}{\mathrm{dt}}=0{,}05.(-4x3{,}705666.e^{-4.t}-1.(-1x3{,}705666).e^{-1.t})$$

s DOMENİ ÇÖZÜMÜ

$$\begin{vmatrix} 5s+4 & -4 \\ -4 & \frac{20}{s}+4 \end{vmatrix} \begin{vmatrix} I_{L(s)} \\ I_{C(s)} \end{vmatrix} = \begin{vmatrix} 11{,}111+\frac{6{,}66}{s} \\ -\frac{6{,}666}{s} \end{vmatrix}$$

$$I_C(s) = \frac{\begin{bmatrix} 5s+4 & 11{,}111+\frac{6{,}66}{s} \\ -4 & -\frac{6{,}666}{s} \end{bmatrix}}{\begin{bmatrix} 5s+4 & -4 \\ -4 & \frac{20}{s}+4 \end{bmatrix}} = \frac{-33{,}333-\frac{26{,}666}{s}+44{,}444+\frac{26{,}666}{s}}{100+20s+\frac{80}{s}+16-16}$$

$$= \frac{11{,}111}{100+20s+\frac{80}{s}} = \frac{11{,}111}{100+20s+\frac{80}{s}} = \frac{11{,}111.s}{(100\mathrm{s}+20\mathrm{s}^2+80}$$

$$= \frac{11{,}111}{(20\mathrm{s}^2+100\mathrm{s}+80)} = \frac{0{,}5555.s}{(\mathrm{s}^2+5\mathrm{s}+4)} = \frac{0{,}5555.s}{(\mathrm{s}+4).(\mathrm{s}+1)}$$

$$= \frac{A}{(\mathrm{s}+4)} + \frac{B}{(\mathrm{s}+1)}$$

$$(A+B).s + (4A+B)$$

$A+B=0{,}5555$ $\quad 4A+B=0$ $\quad$ *-A-B=-0,5555*

$3A=-0{,}5555$ $\quad A=-0{,}185$ $\quad A+B=0{,}5555$

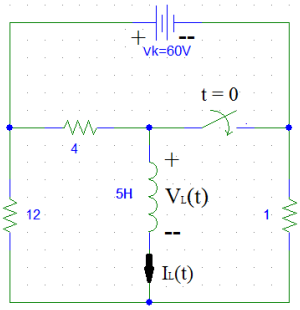
$-0{,}185+B=0{,}5555$ $\quad B=0{,}7407$

$$I_C(s) = \frac{A}{(\mathrm{s}+4)} + \frac{B}{(\mathrm{s}+1)}$$

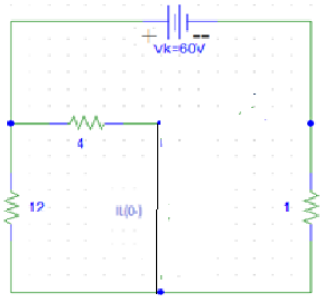
$$I_C(s) = \frac{-0{,}1851}{(\mathrm{s}+4)} + \frac{0{,}7047}{(\mathrm{s}+1)}$$

$$I_C(t) = -0{,}1871.\mathrm{e}^{-4.\mathrm{t}} + 0{,}794.\mathrm{e}^{-1.\mathrm{t}}$$

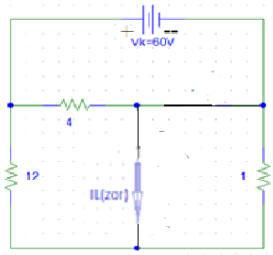
$$V_c(t) = 3{,}705666.e^{-4.t} - 3{,}705666.e^{-1.t} + 8$$



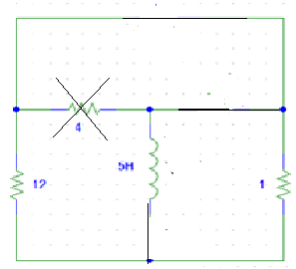
S-3)Şekilde verilen devrede t = 0 anında kapatılıyor. t > 0 için IL(t) ve VL(t)'yi bulunuz.



$$I_L(0^-) = \frac{60}{\frac{12x4}{12+4}+1}.\frac{12}{12+4} = 11{,}25A$$



$$I_L(\infty) = -\frac{60}{\frac{12x4}{12+4}}.\frac{4}{16} = -5A$$



$$\text{Reş} = \frac{12x1}{12+1}$$

$$\tau = \text{L/Reş} \quad = 5/(12x1/(12+1))1 \; = 65/12$$

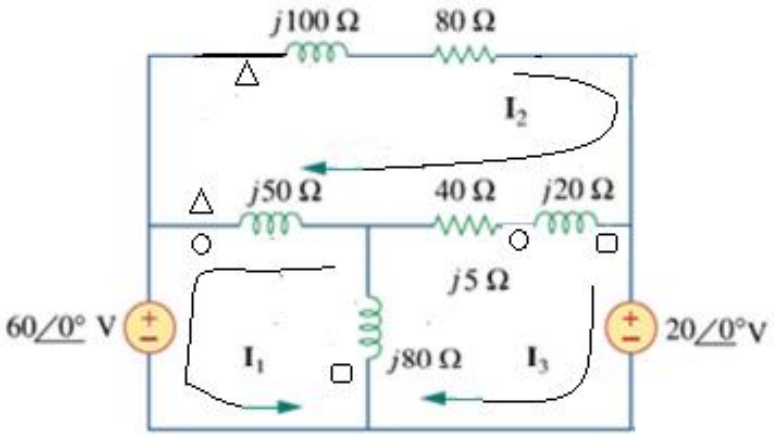
$$I_L(t) = A.e^{-\frac{t}{\tau}} + I_L(\infty) \qquad I_L(t) = A.e^{-\frac{t}{(65/12)}} - 5$$

t = 0 için $I_L(0^+)$ =11,25 A $\qquad 11{,}25 = A.1 - 5 \qquad$ A=16,25

$$I_L(t) = 16{,}25.e^{-(12/65)t} + 11{,}25A$$

$$V_L(t) = L.\frac{d_{iL}}{dt} = 5x\left((16{,}25x(-12/65)\right).e^{-(12/65)t}$$

$$V_L(t) = -15.e^{-(12/65)t}$$



S-4) Şekildeki magnetik kuplajlı devrenin i1, i2, i3 akımlarını matrisel biçimde yazınız. △ = j15 Ohm, □ = j5 Ohm, ○ = j25 Ohm

Cevap4

$j.50.(I_1 + I_2) + j.80.(I_1 + I_3) - j.15.I_2 + j.5.I_2 - j.5.I_3 + j.25.I_2 - j.25.I_3 = -60\angle 0^0$ 10puan

$j.50.(I_2 - I_1) + (40+j.20).(I_2 - I_3) + (80+j.100).(I_2) - j.15.I_1 - 2x\, j.15.I_2 + j.5.I_1 + j.5.I_3 + j.25.I_1 + 2xj.5.I_2 - j.25.I_3 = 0$ 10puan

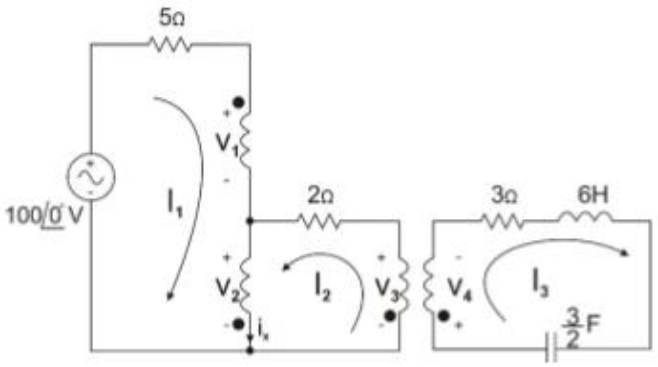
$(40+j.20).(I_3 - I_2) + j.80.(I_1 + I_3) - j5.I_1 + j5.I_2 + 2xj5.I_3 - j25.I_1 - j25.I_2 = -20$ 10puan

$(j.50+ j.80).I_1$ $(j.50- j.15 + j.5 + j.5+j.25).I_2 + (j.80- j.5.I_2 - j.25).I_3 = -60\angle 0^0$

$(j.50 -j.15 + j.5 + j.25).I_1 + (j.50+40+j.20 + 80+j.100-j.30+j.50).I_2$ $(-40-j.20+ j.15 - j25).I_3 = 0$

$(j.80 - j.5.- 25).I_1 + (-40-j.20 + j.5.I_3 - j.25).I_2 + (40+j.20+j.80-j.10).I_3 = -20\angle 0^0$

$$\begin{vmatrix} j.130 & +j.65 & j.50 \\ -j.65 & 120+j.90 & -40-j.39 \\ j.50 & -40-j.30 & 40+j.90 \end{vmatrix} \cdot \begin{vmatrix} I_1 \\ I_2 \\ I_3 \end{vmatrix} = \begin{vmatrix} -60 \\ 0 \\ -20 \end{vmatrix}$$



S-5) Şekildeki verilen devrede, V1=1 sarım, V2=2 sarım, V3=3 sarım , V4=4 sarım ve w = 1/3 ‘ dir. V1 , V2 , V3 , V4 , I1 , I2 , I3 bulunuz.

$\frac{V_1}{V_2} = \frac{N_1}{-N_2}$

$V_1 = -\frac{N_1}{N_2}.V_2 = -\frac{1}{2}.V_2$

$V_2 = -\frac{N_2}{N_1}.V_1 = -\frac{2}{1}.V_1 = -2.V_1$

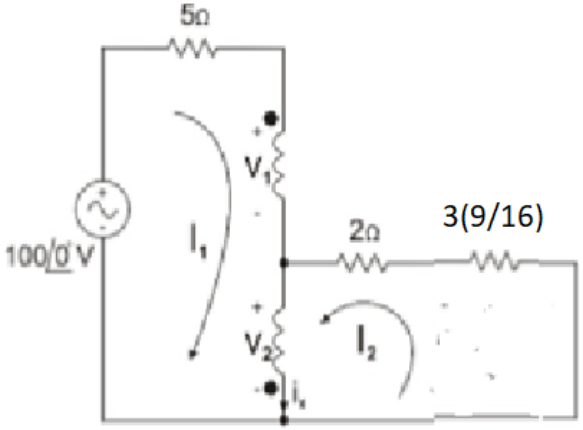
$\frac{V_3}{V_4} = \frac{-N_3}{N_4} = \frac{-3}{4}$ $V_3 = \frac{-3}{4}xV_4$

$\frac{I_1}{I_2} = -\left(\frac{-N_2}{N_1-N_2}\right) = -\left(\frac{-2}{1-2}\right) = -2$

$I_2 = -\left(\frac{N_1-N_2}{-N_2}\right).I_1 = -\left(\frac{1-2}{-2}\right).I_1 = -\frac{1}{2}.I_1$

$\frac{I_2}{I_3} = -\left(\frac{N_4}{N_3}\right) = -\left(\frac{4}{3}\right)$

$I_3 = -\left(\frac{N_3}{N_4}\right).I_2 = -\left(\frac{3}{4}\right).I_2$



$$5.I_1 + V_1 + V_2 = 100$$

$$\left(\frac{27}{16} + 2\right).I_2 + V_2 = 0$$

$$5.I_1 + V_1 - 2.V_1 = 100$$

$$\frac{59}{16}.I_2 - 2V_1 = 0$$

$$5.I_1 - V_1 = 100$$

$$\frac{59}{16}.\left(\frac{-1}{2}\right).I_1 - 2V_1 = 0$$

$$5.I_1 - V_1 = 100$$

$$-1{,}84375.I_1 - 2V_1 = 0$$

$$-10.I_1 + 2.V_1 = -200$$

$$-1{,}84375.I_1 - 2V_1 = 0$$

$$I_1 = \frac{-200}{-11{,}84375} = 16{,}88654354A$$

$$-1{,}8475.I_1 - 2V_1 = 0$$

$$V_1 = -\frac{1{,}84375}{2}.I_1 = -\frac{1{,}84375}{2}x16{,}88654354 = -15{,}6728232V$$

$$V_2 = -2.V_1 = -15{,}6728232 = 31{,}136464V$$

$$I_2 = -\left(\frac{1}{2}\right).I_1 = -\frac{1}{2}x16{,}88654354 = -8{,}443271768A$$

$$I_3 = -\left(\frac{3}{4}\right).I_2 = -\left(\frac{3}{4}\right).(-8{,}443271768) = 6{,}332453826A$$

$$V_4 + 3.I_3 = 0$$

$$V_4 = -3.I_3 = -3x6{,}332453826 = 19V$$

$$V_3 = \frac{-3}{4}xV_4 = \frac{-3}{4}x19 = -14{,}25V$$