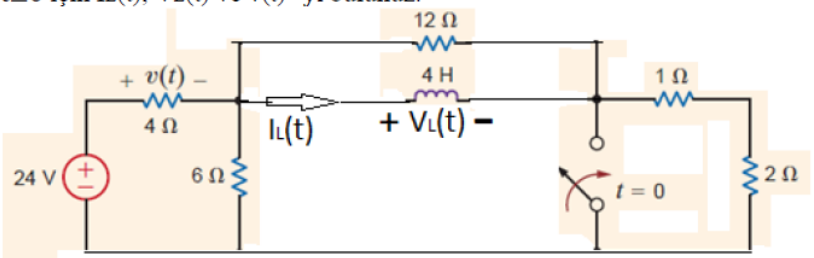
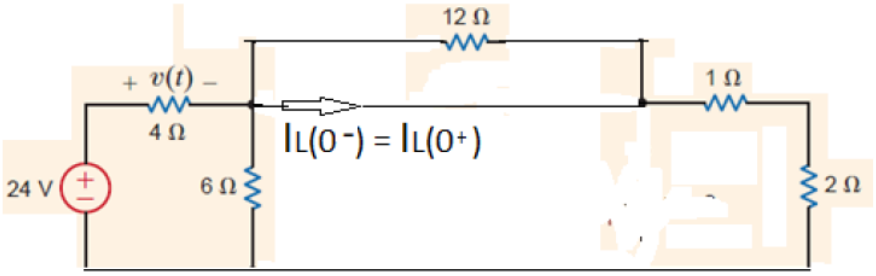
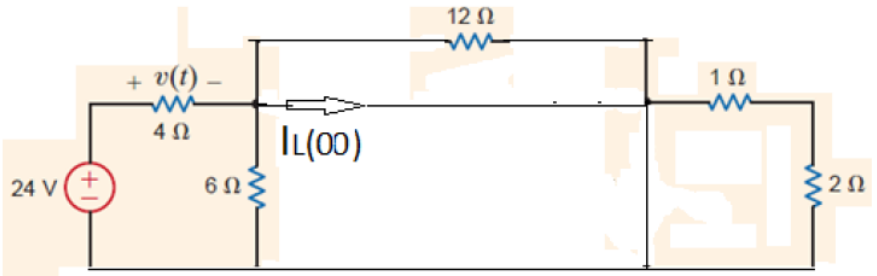
S-1) Anahtar uzun süre açık kaldıktan sonra t=0 anında kapatılmıştır.
t≥0 için $I_L(t)$, $V_L(t)$ ve v(t) ' yi bulunuz.

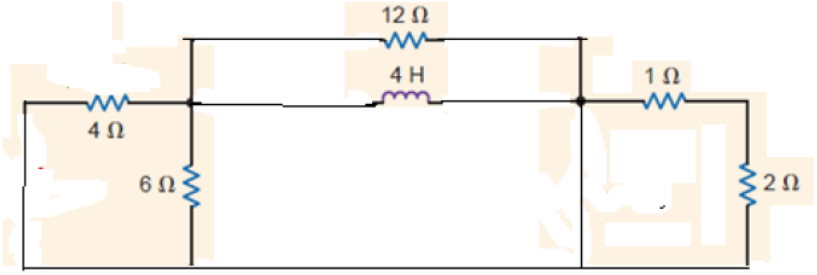




1.durum $I_L(0^-) = \frac{24}{\frac{(2+1)x6}{(2+1)+6}+4} x \frac{6}{2+1+6} = 2{,}666A = I_L(+)$ 5 puan



2.durum $I_L(\infty) = \frac{24}{4} = 6A = ILzor$ 5 puan



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

$$R_{eş} = \frac{\left(\frac{4x6}{4+6}\right)x12}{\left(\frac{4x6}{4+6}\right)+12} = 2\Omega$$

$$\tau = \frac{L}{Reş} = \frac{4}{2}$$ 5 puan

$$r = -\frac{1}{\tau} \qquad \tau = -\frac{1}{r}$$

$$\frac{1}{4}+\frac{1}{6}+\frac{1}{12}+\frac{1}{4.r} = 0$$

$$\underset{3.r}{\frac{1}{4}}+\underset{2.r}{\frac{1}{6}}+\underset{r}{\frac{1}{12}}+\underset{3}{\frac{1}{4.r}} = 0$$

$$3.r + 2.r + r + 3 = 0$$

$$6.r + 3 = 0$$

$$r = -\frac{3}{6} = -\frac{1}{2}$$

$$I_L(t) = \text{A}.\,e^{-\frac{t}{\tau}} + I_L(\infty)$$

$$I_L(t) = \text{A}.\,e^{-\frac{t}{2}} + 6$$

t = 0 için $I_L(0^+) = 2{,}666A$

$$2{,}666 = \text{A}.1 + 6 \qquad \text{A} = -3{,}333$$ 4 puan

$$I_L(t) = \text{A}.\,e^{-\frac{t}{\tau}} + I_L(\infty)$$

$$I_L(t) = \left(-3{,}333.\,e^{-\frac{t}{2}} + 6\right).u(t)A$$ 5 puan

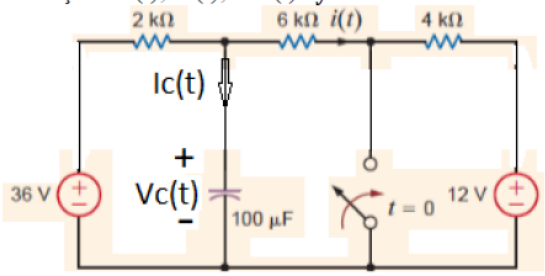
$$V_L(t) = L.\frac{d_{iL}}{dt} = 4.\left((-3{,}333).\left(-\frac{1}{2}\right)e^{-\frac{t}{2}}\right) = \left(6{,}666.\,e^{-\frac{t}{2}}\right)$$ 5 puan

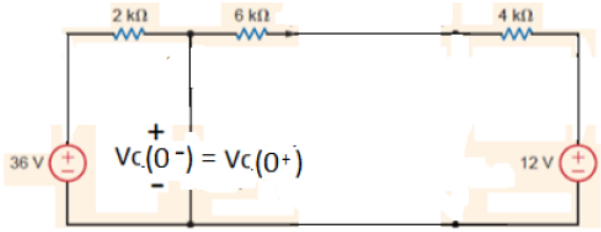
$$V_R(t) + V_L(t) - 24 = 0$$

$$V_R(t) = 24 - V_L(t)$$

$$V_R(t) = 24 - 6{,}666.\,e^{-\frac{t}{2}}$$ 5 puan

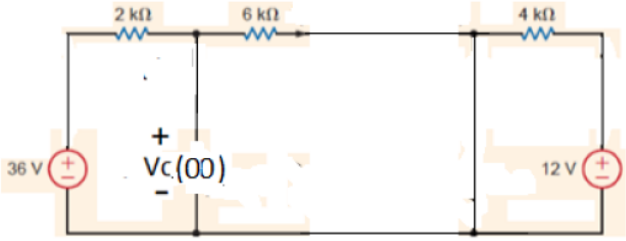
S-2)Anahtar uzun bir süre açık kaldıktan sonra t=0 anında kapatılmıştır.
t≥0 için Vc(t), Ic(t), ve i(t) ' yi bulunuz. C= 100 mikro farat = 100x10^{-6} F



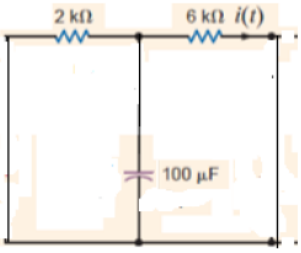


1.durum $-V_c(0^-) + (6000 + 4000)x\frac{36-12}{(2000+6000+4000)} + 12 = 0$

$V_c(0^-) = (6000 + 4000)x0{,}002 + 12 = 32 = V_c(0^+)$ 5 puan



2.durum $V_c(\infty) = \frac{36}{(2000+6000)}x6000 = 27V = V_c zor$ 5 puan



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

$R_{eş} = \frac{2000x6000}{2000+6000} = 1500\Omega$

$\tau = R_{eş}xC = 1500x100x10^{-6} = 0{,}15$ 5 puan

$r = -\frac{1}{\tau} \qquad \tau = -\frac{1}{r}$

$\frac{1}{2000} + \frac{1}{6000} + \frac{1}{\frac{1}{0{,}0001.r}} = 0$

$\frac{1}{2000} + \frac{1}{6000} + \frac{0{,}0001.r}{1} = 0$

$\frac{3}{6000} + \frac{1}{6000} + \frac{0{,}0001.r}{1} = 0$

$3 + 1 + 0{,}6.r = 0$

$4 + 0{,}6.r = 0$

$r = -\frac{4}{0{,}6} = -6{,}666$

$V_C(t) = A.e^{-\frac{t}{\tau}} + V_C(\infty)$

$V_C(t) = A.e^{-\frac{t}{0{,}15}} + 27$

A katsayısı başlangıç şartı olan $V_C(0^+)$'dan bulunur.

t= 0 için $V_c(0^+) = 32V$

$32 = A.1 + 27 \qquad A = 5$ 4 puan

$V_C(t) = A.e^{-\frac{t}{\tau}} + V_C(\infty)$

$V_C(t) = \left(5.e^{-\frac{t}{0{,}15}} + 27\right).u(t)V$ 5 puan

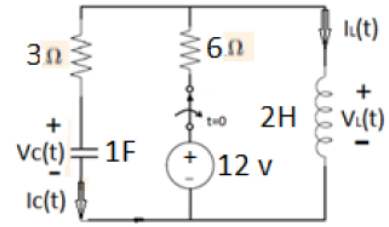
$I_C(t) = C.\frac{dVc(t)}{dt} = 100x10^{-6}.\left((5).\left(-\frac{1}{0{,}15}\right).e^{-\frac{t}{0{,}15}}\right)$

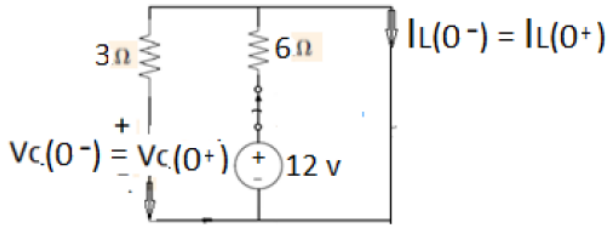
$I_C(t) = \left(3{,}333.e^{-\frac{t}{0{,}15}}\right)mA$ 5 puan

$-V_c(t) + 6000xi(t) = 0$

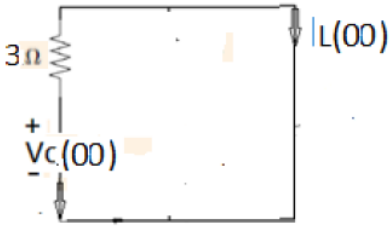
$i(t) = \frac{Vc(t)}{6000} = \frac{5.e^{-\frac{t}{0{,}15}}+27}{6000} = \left(0{,}833.e^{-\frac{t}{0{,}15}} + 4{,}5\right)mA$ 5 puan

S-3) Anahtar uzun süre uzun kapalı konumda kaldıktan sonra anahtar t=0 anında açılmaktadır. t≥0 için Vc(t) , Ic(t), yada IL(t), VL(t) yi bulunuz.

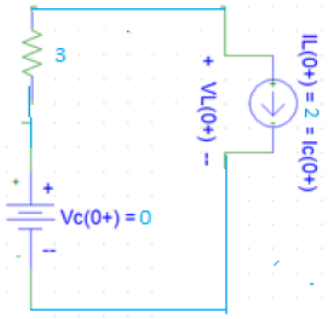




1.durum $I_L(0^-) = \frac{12}{6} = 2A = I_L(0^+)$ $V_C(0^-) = 0 = V_C(0^+)$



2.durum $I_L(\infty) = 0 = ILzor$ $V_C(\infty) = 0 = V_Czor$



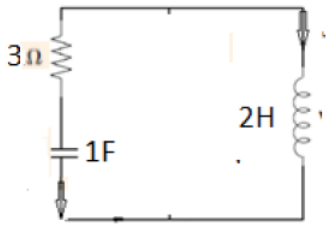
$V_R(0^+) + V_c(0^+) - V_L(0^+) = 0$

3. $I_L(0^+) + V_c(0^+) - V_L(0^+) = 0$

$V_L(0^+) = 3xI_L(0^+) - V_c(0^+)$

$V_L(0^+) = 3x2 - 0$ $V_L(0^+) = 6$

$I_L(0^-) = \frac{12}{6} = 2A = I_L(0^+) = -I_C(0^+) = -2$



2. durum $\frac{1}{3}+\frac{1}{2.r+\frac{1}{r.1}}=0$ $\frac{1}{3}+\frac{r.1}{2.r^2+1}=0$

$$\frac{\frac{1}{3}}{2.r^2+1}+\frac{r.1}{3}=0$$

$2.r^2+1+3.r=0$ $2.r^2+3.r+1=0$

$r_1,r_2=\frac{-b\mp\sqrt{b^2-4.a.c}}{2.a}$ $r_1,r_2=\frac{-3\mp\sqrt{3^2-4.2.1}}{2.2}=\frac{-3\mp\sqrt{9-8}}{4}=-0{,}75\mp0{,}25$

$r_1=-1$ $r_2=-0{,}5$ $(r_1+1).(r_2+0{,}5)=0$

$I_L(t)=A.e^{r.t}+B.e^{r.t}+I_L(\infty)$ $I_L(t)=A.e^{-1.t}+B.e^{-0{,}5.t}+0$

$I_L(t)=A.e^{-1.t}+B.e^{-0{,}5.t}+0$

t = 0 için $I_L(0^+)=2$ $2=A.1+B.1+0$ $A+B=2$

$V_L(t)=L.\frac{d_{iL}}{dt}=2.\left((-1).A.e^{-1.t}+(-0{,}5).B.e^{-0{,}5.t}\right)$

t = 0 için $V_L(0^+)=6$ $6=2.\left((-1).A.1+(-0{,}5).B.1\right)$

$-1.A-0{,}5.B=3$ $A+B=2$

$+1.A+1.B=2$ $0{,}5.B=5$ $B=\frac{5}{0{,}5}=10$

$A+B=2$ $A+10=2$ $A=-8$

$I_L(t)=A.e^{-1.t}+B.e^{-0{,}5.t}+I_L(\infty)$

$I_L(t)=-8.e^{-1.t}+10.e^{-0{,}5.t}+0$

$V_L(t)=L.\frac{d_{iL}}{dt}=2.\left((-1).A.e^{-1.t}+(-0{,}5).B.e^{-0{,}5.t}\right)$

$V_L(t)=2.((-1).(-8).e^{-1.t}+(-0{,}5).(10).e^{-0{,}5.t})$

$V_L(t)=16.e^{-1.t}-10.e^{-0{,}5.t}$

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

$V_c(t) = A.e^{-1.t} + H.e^{-0,5.t} + 0$

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

$I_C(t) = C.\frac{d_{VC}}{dt} = 1.\left((-1).A.e^{-1.t} + (-0,5).B.e^{-0,5.t}\right)$

t = 0 için $I_c(0^+) = -2 \quad -2 = 1.\left((-1).A.1 + (-0,5).B.1\right)$

$-1.A - 0,5.B = -2 \quad A + B = 0$

$-1.A * 0,5.B = -2$

$-1.A - 0,5.B = -2$

$1.A + 1.B = 0$

$0,5.B = -2 \quad B = \frac{-2}{0,5} = -4$

$A + B = 0 \quad A - 4 = 0 \quad A = 4$

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

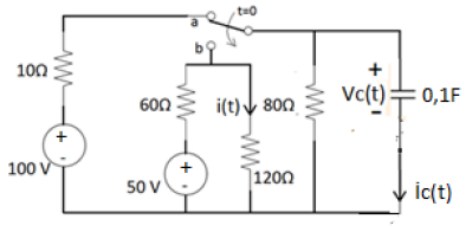
$V_c(t) = 4.e^{-1.t} - 4.e^{-0,5.t} + 0$

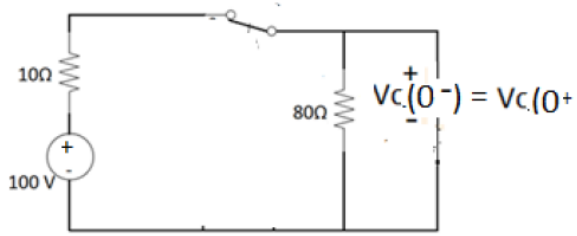
$I_C(t) = C.\frac{d_{VC}}{dt} = 1.\left((-1).A.e^{-1.t} + (-0,5).B.e^{-0,5.t}\right)$

$I_C(t) = 1.\left((-1).(4).e^{-1.t} + (-0,5).(-4).e^{-0,5.t}\right)$

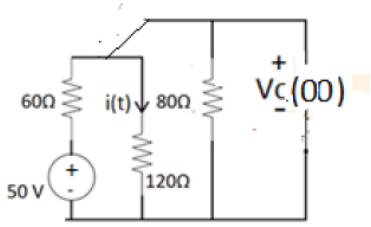
$I_C(t) = -4.e^{-5.t} + 2.e^{-0,5.t}$

S-4) Aşağıda verilen devrede anahtar uzun bir süre "a" konumunda kaldıktan sonra t=0 anında "b" konumuna alınıyor. a) t≥0 için,Vc(t)'yi ve i(t)'yi bulunuz. b) i(0,3s),Vc(0,7s)'yi hesaplayınız.
C = 0,1 F

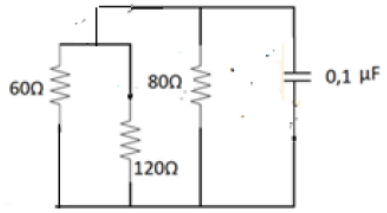




1.durum $V_c(0^-) = \frac{100}{(10+80)} x80 = 88{,}888V = V_c(0^+)$ 5 puan



2.durum $V_c(\infty) = \frac{50}{\frac{120x80}{120+80}+60} x \frac{120}{120+80} x80 = 22{,}222V = V_c zor$ 5 puan



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

$$R_{eş} = \frac{\left(\frac{120x80}{120+80}\right)x60}{\left(\frac{120x80}{120+80}\right)+60} = \frac{2880}{108} = 26{,}666\Omega$$

$$\tau = R_{eş}xC = 26{,}666x0{,}1 = 2{,}666$$ 5 puan

$$r = -\frac{1}{\tau} \qquad \tau = -\frac{1}{r}$$

$$\frac{1}{60} + \frac{1}{120} + \frac{1}{80} + \frac{1}{\frac{1}{0{,}1.r}} = 0$$

$$\frac{1}{60} + \frac{1}{120} + \frac{1}{80} + \frac{0{,}1.r}{1} = 0$$
$$4 \quad 2 \quad 3 \quad 240$$

$$4 + 2 + 3 + 24.r = 0$$

$$9 + 24.r = 0$$

$$r = -\frac{9}{24} = -0{,}375$$

$$V_C(t) = \text{A. e}^{-\frac{t}{\tau}} + V_C(\infty)$$

$$V_C(t) = \text{A. } e^{\frac{-t}{2{,}666}} + 22{,}222$$

A katsayısı başlangıç şartı olan $V_C(0^+)$'dan bulunur.

t= 0 için $V_c(0^+) = 88{,}888V$

$$88{,}888 = \text{A. } 1 + 22{,}222 \qquad A = 66{,}666$$ 4 puan

$$V_C(t) = \text{A. e}^{-\frac{t}{\tau}} + V_C(\infty)$$

$$V_C(t) = \left(66{,}666.\ e^{\frac{-t}{2{,}666}} + 22{,}222\right).u(t)V$$ 5 puan

$$V_C(0{,}7) = \left(66{,}666.e^{\frac{-0{,}7}{2{,}666}} + 22{,}222\right)V$$

$$V_C(0{,}7) = (51{,}271 + 22{,}222) = 73{,}493V$$ 5 puan

$$i(t) = \frac{Vc(t)}{120} \qquad i(t) = \frac{66{,}666\ e^{\frac{-t}{2{,}666}} + 22{,}222}{120}$$

$$i(t) = \frac{66{,}666\text{-}e^{\frac{-0{,}3}{2{,}666}} + 22{,}222}{120} = \frac{59{,}555+22.222}{120} = 0{,}68A$$ 5 puan