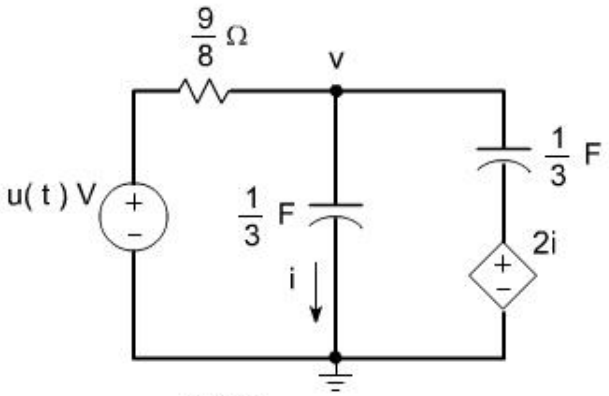
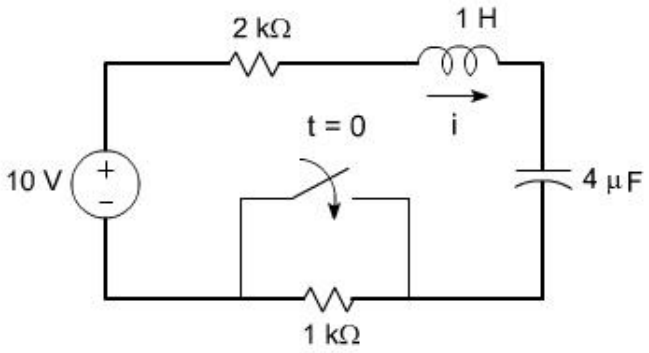
ELEKTRİK DEVRELERİ I FİNAL 2010 - 2011

SORU 1 -) ***Şek.1de*** $v(0^+)$, $dv/dt\big|_{0+}$ ***ve birim basamak fonksiyonuna devrenin cevabı*** v ***gerilimini bulunuz.***



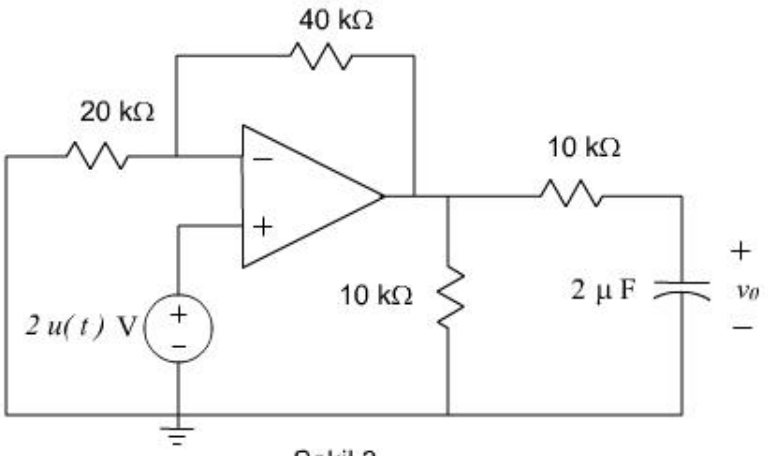
Şekil1

SORU 2 -) ***Şekil 2 deki devrede,*** $t = 0$ ***da devre kararlı haldedir.*** $t > 0$ ***için*** i ***akımını bulunuz.***



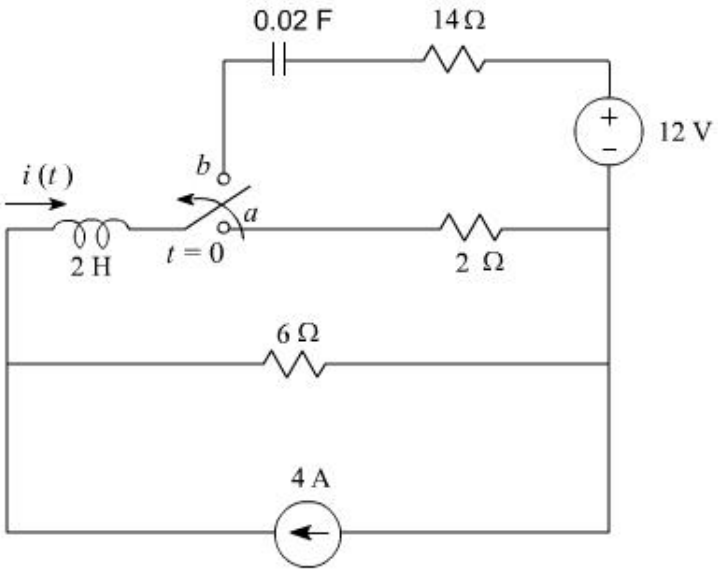
Şekil 2

SORU 3 -) ***Şekil 3 deki devrede*** $t > 0$ ***için*** $v_0(t)$ ***gerilimini bulunuz.***



Şekil 3

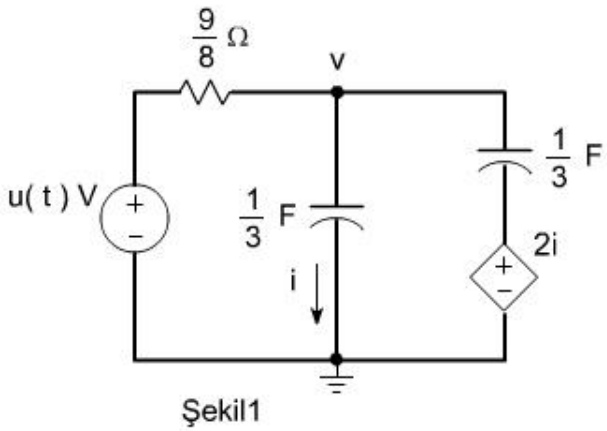
SORU 4 -) ***Şekil 4 deki devrede, anahtar*** a ***konumunda iken devre kararlı haldedir.*** $t = 0$ ***anında anahtar*** a ***konumundan*** b ***konumuna getiriliyor.*** $t > 0$ ***için*** i ***akımını bulunuz.***



Şekil 4

ÇÖZÜMLER

ÇÖZÜM 1 -) .



Şekil1

$t < 0$ ***için kondansatörde yük yok***

$v(0^-) = v(0^+)0$

$dv/dt|_{0+} = 0$

$i = \frac{1}{3}\frac{dv}{dt}$

$$\frac{v-1}{9/8}+\frac{1}{3}\frac{dv}{dt}+\frac{1}{3}\frac{d}{dt}(v-2i)=0,\quad \frac{8v}{9}+\frac{1}{3}\frac{dv}{dt}+\frac{1}{3}\frac{d}{dt}\left(v-\frac{2}{3}\frac{dv}{dt}\right)=\frac{8}{9}$$

$$\frac{8v}{9}+\frac{2}{3}\frac{dv}{dt}+-\frac{2}{9}\frac{d^2v}{dt^2}=\frac{8}{9},\quad \frac{d^2v}{dt^2}-3\frac{dv}{dt}-4v=-4$$

$$\frac{d^2v}{dt^2}-3\frac{dv}{dt}-4v=-4$$

$$\frac{d^2v}{dt^2}-3\frac{dv}{dt}-4v=0,\quad s^2-3s-4=0,\ s_1=\frac{3+\sqrt{9-4\times(-4)}}{2}=4,\quad s_2=-1$$

$$v_n = Ae^{4t} + Be^{-t}$$

$$v_f = K,\ \frac{d^2}{dt^2}(K) - 3\frac{d}{dt}(K) - 4K = -4, \quad v_f = K = 1$$

$$v = v_n + v_f = Ae^{4t} + Be^{-t} + 1$$

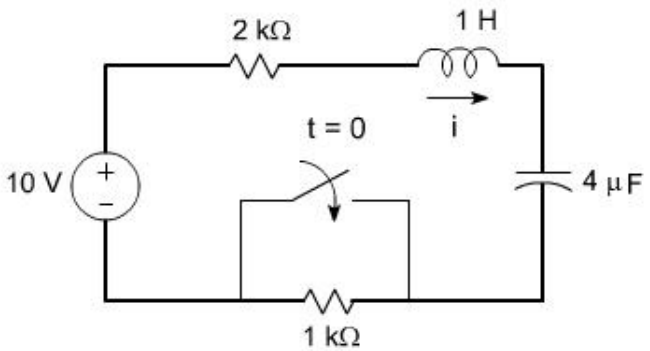
$$v(0) = 0 = Ae^{4\times 0} + Be^{-0} + 1, \quad A + B = -1$$

$$\left.\frac{dv}{dt}\right|_{0+} = 0 = 4Ae^{4t} - Be^{-t}, \quad B = 4A$$

$$A + 4A = -1, \quad A = -\frac{1}{5}, \quad B = -\frac{4}{5}$$

$$v = -\frac{1}{5}e^{4t} - \frac{4}{5}e^{-t} + 1 = 1 - \frac{1}{5}\left(e^{4t} + 4e^{-t}\right)$$

ÇÖZÜM 2 -)



Şekil 2

$$t = 0,\ i(0) = 0, \quad v_C(0) = 10\,V$$

$$-10 + 2\times 10^3 i + 1\frac{di}{dt} + \frac{1}{4\times 10^{-6}}\int i dt = 0$$

$$\frac{di}{dt} + 2\times 10^3 i + 25010^3\int i dt = 10$$

$$\frac{d^2 i}{dt^2} + 2\times 10^3\frac{di}{dt} + 250\times 10^3 i = 0$$

$$s^2 + 2\times 10^3 s + 250\times 10^3 = 0$$

$$s_1 = \frac{-2\times 10^3 + \sqrt{4\times 10^6 - 4\times 250\times 10^3}}{2} = (-1 + \sqrt{3}/2)10^3$$

$$i = Ae^{-134t} + Be^{-1866t}$$

$$\frac{di}{dt} + 2\times 10^3 i + \frac{1}{4\times 10^{-6}}\int i dt = 10$$

$$\left.\frac{di}{dt}\right| = -2\times 10^3 i(0) - v_C(0) = -10$$

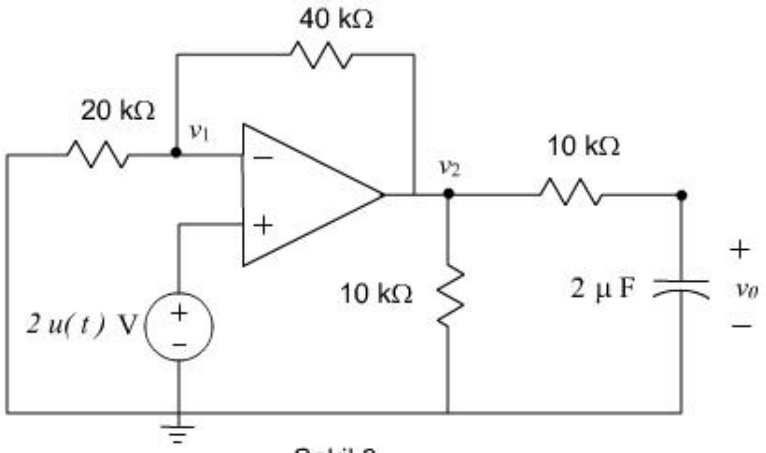
$$i(0) = Ae^{-134\times 0} + Be^{-1866\times 0} = A + B = 0$$

$$\left.\frac{di}{dt}\right| = -134Ae^{-134\times 0} - 1866Be^{-1866\times 0} = -134A - 1866B = -10$$

$$= 134B - 1866B = -10, \quad B = 10/1732, \quad A = -10/1732$$

$$i = -\frac{10}{1732}e^{-134t} + \frac{10}{1732}e^{-1866t}$$

ÇÖZÜM 3 -)



Şekil 3

$v_0(0) = 0$

$v^+ - v^- = 0 \quad \rightarrow \quad v^- = v_1 = v^+ = 2$

1.düğüm

$$\frac{v_1}{20k} + \frac{v_1 - v_2}{40k} = 0\,, \quad 2v_1 + v_1 - v_2 = 0$$

$$v_2 = 3v_1 = 3 \times 2 = 6$$

v_0 için düğüm denklemi

$$\frac{v_0 - v_2}{10 \times 10^3} + 2 \times 10^{-6}\frac{dv_0}{dt} = 0$$

$$\frac{dv_0}{dt} + \frac{v_0 - v_2}{2 \times 10^{-6} \times 10 \times 10^3} = 0$$

$$\frac{dv_0}{dt} + \frac{v_0 - v_2}{2 \times 10^{-2}} = 0, \qquad \frac{dv_0}{dt} + 50(v_0 - v_2) = 0, \qquad \frac{dv_0}{dt} + 50(v_0 - 6) = 0$$

$$\frac{dv_0}{dt} + 50v_0 = 300$$

Doğal çözüm

$$\frac{dv_0}{dt} + 50v_0 = 0$$

$$s + 50 = 0, \qquad s = -50$$

$$v_{0n} = Ae^{-50t}$$

Zorlanmış çözüm

$$\frac{dv_0}{dt} + 50v_0 = 300$$

Denkleminin $v_{0f} = K$ şeklinde bir çözümü vardır.

$\frac{dK}{dt} + 50K = 300, \qquad K6, \qquad v_{0f} = K = 6$

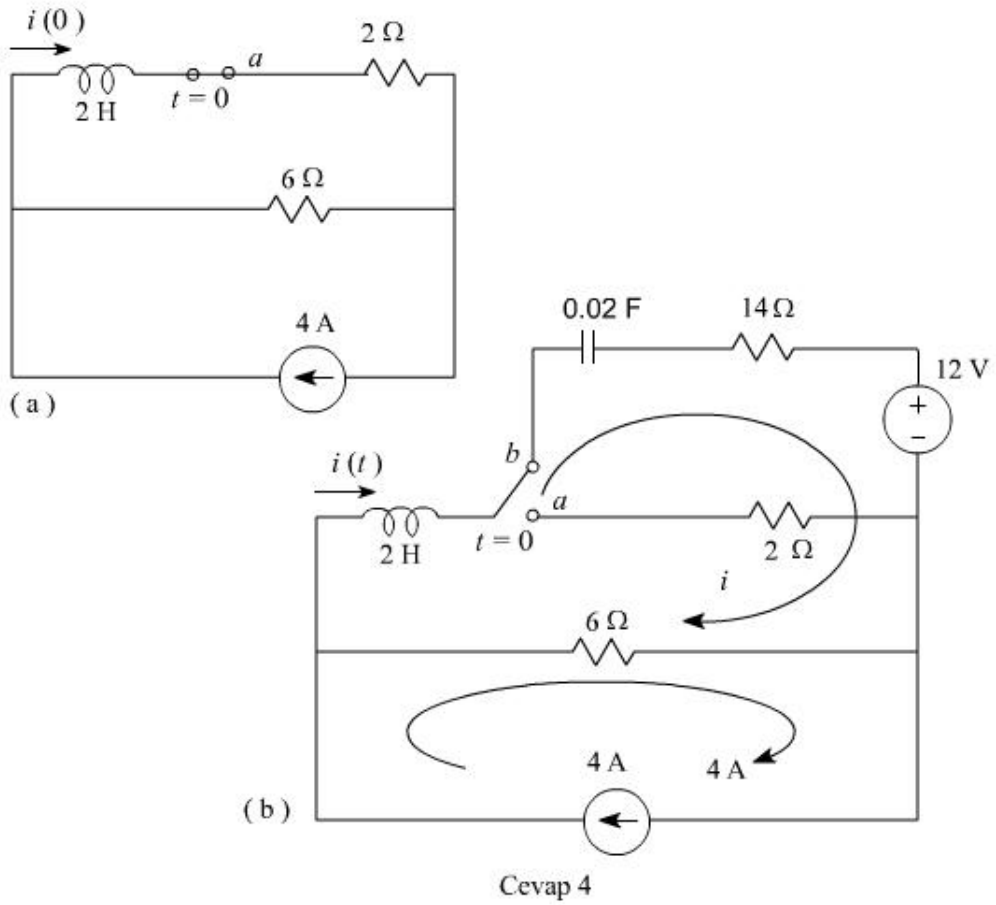
Tam çözüm

$v_0 = v_{0n} + v_{0f} = Ae^{-50t} + 6$

$v_0(0) = 0 = Ae^{-50\times0} + 6, \quad A = -6$

$v_0 = (-6e^{-50t} + 6)u(t)$

ÇÖZÜM 4 -) ***Cevap 4 (a) dan , $t < 0$ için , $i(0) = 4\frac{6}{6+2} = 3\ A, \quad v_V(0) = 0$***



Cevap 4

Cevap 4 (b) den

$12 + 6(i-4) + 2\frac{di}{dt} + \frac{1}{0.02}\int idt + 14i = 0$	
$2\frac{di}{dt} + 20i + 50\int idt = 12$	$\left.\frac{di}{dt}\right\|_0 = 6 - 10i(0) - \frac{1}{2}v_C(0) = -24$

$2\frac{d^2i}{dt^2} + 20\frac{di}{dt} + 50i = 0$	$\frac{d^2i}{dt^2} + 10\frac{di}{dt} + 25i = 0$

$s^2 + 10s + 25 = 0$, $s_{1,2} = \frac{-10\pm\sqrt{10^2-4\times25}}{2}$=-5 ***iki katlı kök***

$i = (A + Bt)e^{-5t} \quad i(0) = 3 = (A + B \times 0)e^{-0}\,, \qquad A = 3$

$\frac{di}{dt} = Be^{-5t} - 5(A + Bt)e^{-5t}$

$\left.\frac{di}{dt}\right|_0 = B - 5A = -24 \;\rightarrow B = 5A - 24 = 5 \times 3 - 24 = -9$

$i = (3 - 9t)e^{-5t}$