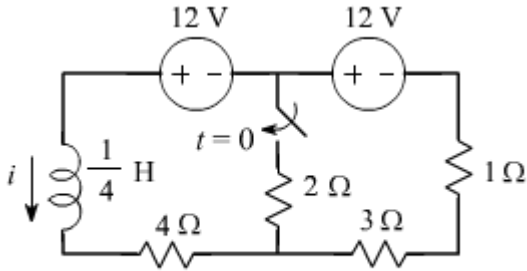
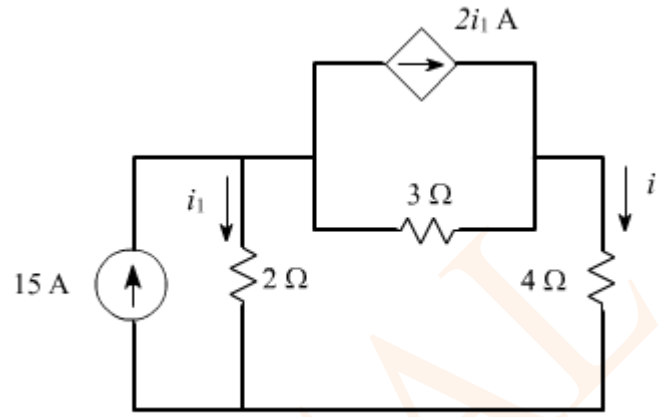


ELEKTRİK DEVRELERİ I FİNAL 2005 - 2006



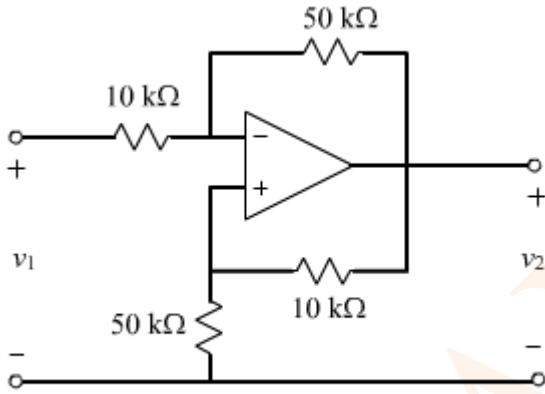
Şekil 1

SORU 1 -) Şekil 1 deki devrede $t = 0^-$ için devre kararlı haldedir. $t > 0$ için i akımını bulunuz.



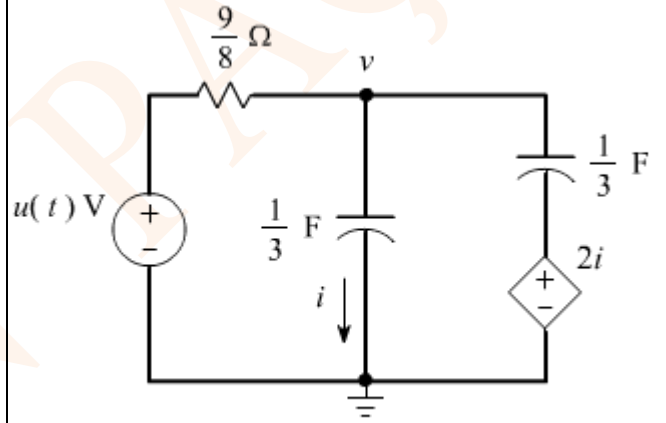
Şekil 2

SORU 2 -) Şekil 2 deki devrede i, i_1 akımlarını düğüm gerilimleri analizini kullanarak bulunuz.



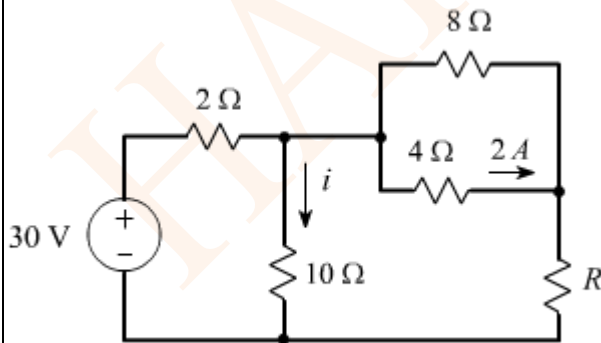
Şekil 3

SORU 3 -) Şekil 3 deki devrede v_2 / v_1 gerilim transfer fonksiyonunu bulunuz.



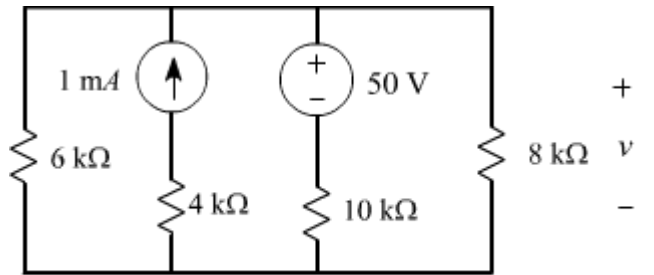
Şekil 4

SORU 4 -) Şekil 4de $v(0^+)$, $dv/dt|_{0^+}$ ve birim basamak fonksiyonuna devrenin cevabı v gerilimini bulunuz.



Şekil 5

SORU 5 -) Şekil 5 deki devrede i ve R yi bulunuz.



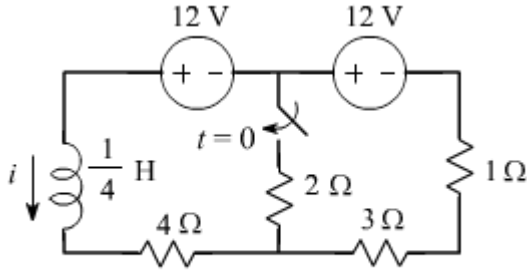
Şekil 6

SORU 6 -) Şekil 6 daki devrede Thevenin - Norton dönüşümü yardımı ile v gerilimini bulunuz.

NOT : Sınav süresi 90 dakikadır. Her soru eşit puandır. Yukarıdaki sorulardan 5 tanesine cevap veriniz.

ÇÖZÜMLER

ÇÖZÜM 1 -)



Şekil 1

$$t = 0^- \text{ de}$$

$$i(0) = \frac{24}{8} = 3 \text{ A}$$

$t > 0$ için : Çevre akımları ile

$$-12 + \frac{1}{4} \frac{di}{dt} + 4i + 2(i - i_1) = 0, \quad \frac{1}{4} \frac{di}{dt} + 6i - 2i_1 = 12, \quad \frac{di}{dt} + 24i - 8i_1 = 48$$

$$-12 + 2(i_1 - i) + 4i_1 = 0, \quad 6i_1 - 2i = 12, \quad 8i_1 = 16 + \frac{8i}{3}$$

$$\frac{di}{dt} + 24i - \left(16 + \frac{8i}{3}\right) = 48, \quad \frac{di}{dt} + \frac{64}{3}i = 64$$

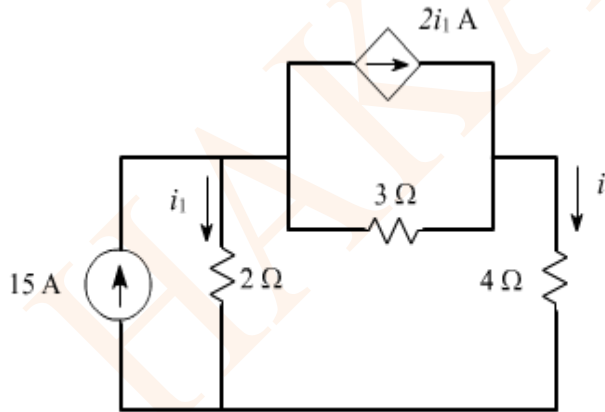
$$\frac{di}{dt} + \frac{64}{3}i = 64, \quad i_n = Ae^{-64t/3}, \quad i_f = K, \quad \frac{d}{dt}(K) + \frac{64}{3}K = 64, \quad K = i_f = 3$$

$$i = i_n + i_f = Ae^{-64t/3} + 3$$

$$i(0) = 3 = Ae^{-64 \times 0/3} + 3, \quad A = 0$$

$$i = 3 \text{ A}$$

ÇÖZÜM 2 -)



Şekil 2

$$i_1 = \frac{v_1}{2}, \quad 2i_1 = v_1$$

$$-15 + \frac{v_1}{2} + \frac{v_1 - v}{3} + 2i_1 = 0, \quad \frac{v_1}{2} + \frac{v_1 - v}{3} + \frac{6v_1}{6} = 15, \quad 11v_1 - 2v = 90$$

$$\frac{v}{4} + \frac{v - v_1}{3} - 2i_1 = 0, \quad \frac{v}{4} + \frac{v - v_1}{3} - \frac{12v_1}{12} = 0, \quad -16v_1 + 7v = 0$$

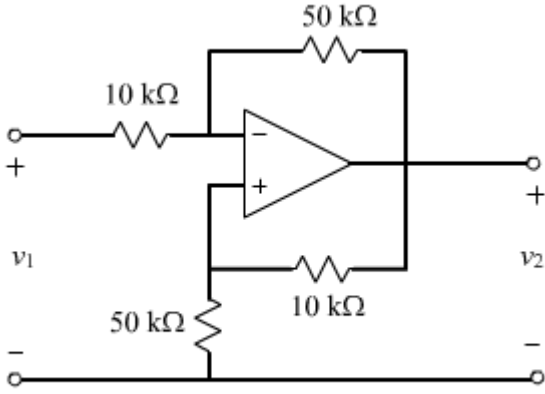
$$\begin{bmatrix} 11 & -2 \\ -16 & 7 \end{bmatrix} \begin{bmatrix} v_1 \\ v \end{bmatrix} = \begin{bmatrix} 90 \\ 0 \end{bmatrix}, \quad \Delta = \begin{vmatrix} 11 & -2 \\ -16 & 7 \end{vmatrix} = 45,$$

$$\Delta_1 = \begin{vmatrix} 90 & -2 \\ 0 & 7 \end{vmatrix} = 630, \quad \Delta_2 = \begin{vmatrix} 11 & 90 \\ -16 & 0 \end{vmatrix} = 1440$$

$$v_1 = \frac{\Delta_1}{\Delta} = \frac{630}{45} = 14 \text{ V}, \quad v = \frac{\Delta_2}{\Delta} = \frac{1440}{45} = 32 \text{ V}$$

$$i_1 = \frac{14}{2} = 7 \text{ A}, \quad i = \frac{32}{4} = 8 \text{ A}$$

ÇÖZÜM 3 -)



Şekil 3

$$\frac{v^- - v_1}{10k} + \frac{v^- - v_2}{50k} = 0, \quad 6v^- = 5v_1 + v_2$$

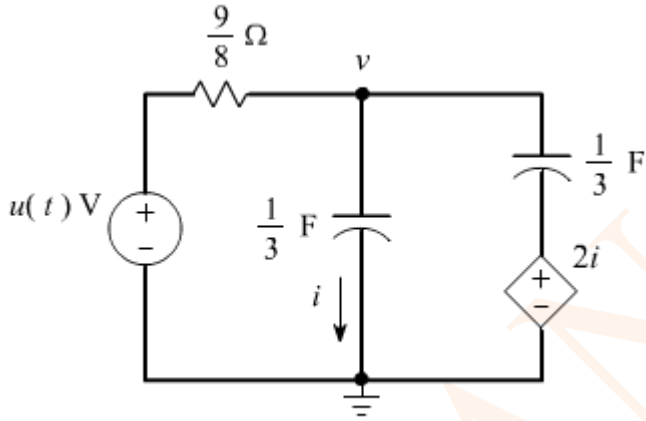
$$\frac{v^+ - v_2}{10k} + \frac{v^+}{50k} = 0, \quad 6v^+ = 5v_2$$

$v^- = v^+$ olduğundan

$$\frac{v^- - v_1}{10k} + \frac{v^- - v_2}{50k} = 0, \quad 6v^- = 5v_1 + v_2$$

$$5v_2 = 5v_1 + v_2, \quad 4v_2 = 5v_1, \quad \frac{v_2}{v_1} = \frac{5}{4}$$

ÇÖZÜM 4 -)



Şekil 4

$t < 0$ için kondansatörde yük yok

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

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

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

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

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

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

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

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

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

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

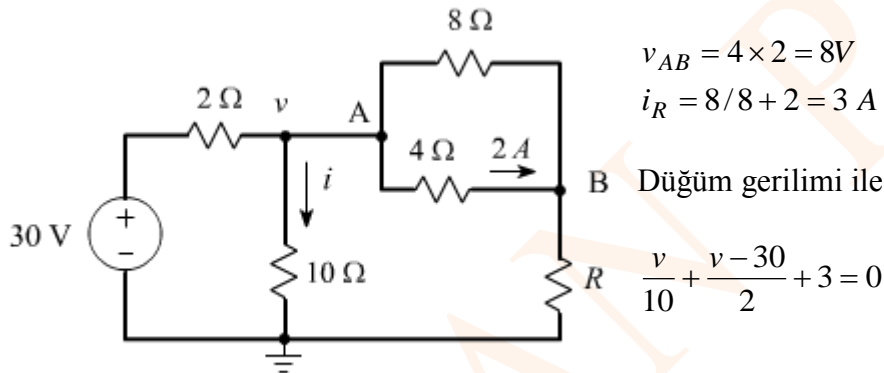
$$v(0) = 0 = Ae^{4 \times 0} + Be^{-0} + 1, \quad A + B = -1$$

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

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

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

ÇÖZÜM 5 -)



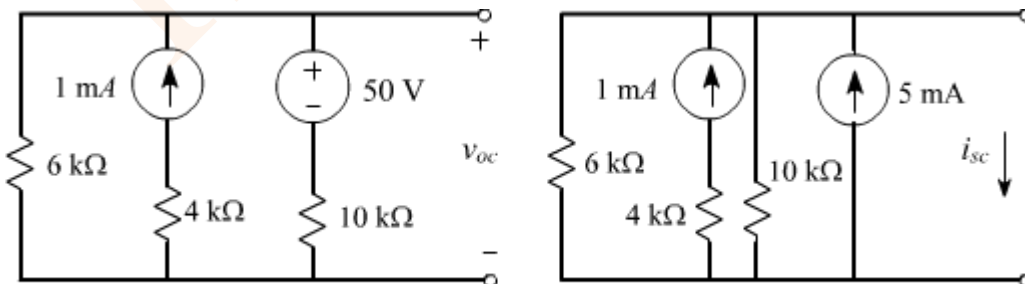
Şekil 5

$$\frac{v}{10} + \frac{5v-150}{10} + 3 = 0, \quad 6v = 150 - 30 = 120, \quad v = 20V$$

$$i = \frac{20}{10} = 2A$$

$$v_R = 20 - 8 = 12V, \quad R = \frac{12}{3} = 4\Omega$$

ÇÖZÜM 6 -)



Şekil 6a

$$\frac{v}{6 \times 10^3} + \frac{v-50}{10 \times 10^3} - 1 \times 10^{-3} = 0$$

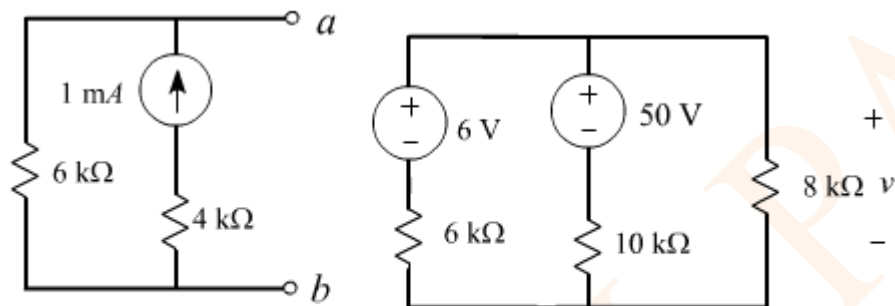
$$\frac{10v+6v}{60} = 1 + \frac{50}{10} = 6, \quad \frac{16v}{60} = 6, \quad v_{oc} = \frac{45}{2} = 22.5 \text{ V}$$

$$i_{sc} = 1 + 5 = 6 \text{ mA}$$

$$R_T = \frac{22.5}{6 \times 10^{-3}} = \frac{15}{4} = 3.75 \text{ k}\Omega$$

$$v = \frac{22.5}{(3.75+8) \times 10^3} \times 8 \times 10^3 = \frac{22.5}{11.75} \times 8 = \frac{180}{11.75} = \frac{720}{47} = 15.32 \text{ V}$$

6-b)



$$V_{ab} = 1 \text{ mA} \times 6 \text{ k}\Omega = 6 \text{ V}$$

$$R_T = 6 \text{ k}\Omega$$

Şekil 6b

$$\frac{v-6}{6k} + \frac{v-50}{10k} + \frac{v}{8k} = 0$$

$$\frac{v}{6} + \frac{v}{10} + \frac{v}{8} = 1 + 5 = 6, \quad \left(\frac{1}{6} + \frac{1}{10} + \frac{1}{8} \right) v = 6, \quad v = \frac{6 \times 480}{188} = 15.32 \text{ V}$$