یا علی

رضا ادیبی پور
۹۸۱۴۳۰۳
تمرین سری 4 الکترونیک

#4_2

$R = 25\,\Omega$
$I_{avg} = ?$
$V_s = 120\ V\ (rms)$
$f = 60\ Hz$

تک دیود : $V_o = \frac{2V_m}{\pi} = \frac{2 \times 120\sqrt{2}}{\pi} = 108^{V}$

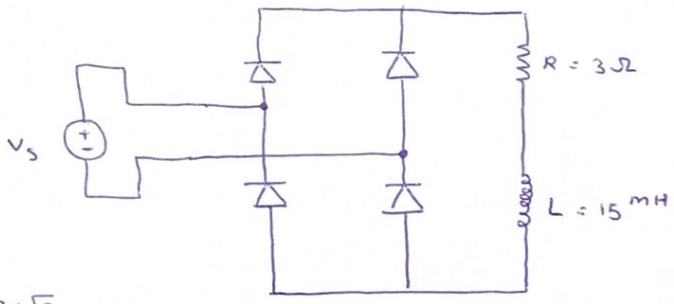
$I_o = \frac{V_o}{R} = \frac{108}{25} = 4.32^{A}$

ترانس با سر وسط : $V_m = 120\sqrt{2}$, $I_o = \frac{V_m}{R} = 4.32^{A}$

$PIV = 2V_m = 2(120)\sqrt{2} = 340^{V}$

#4_11

$V_s(\omega t) = 170 \sin \omega t$
$R = 3\,\Omega$
$L = 15\ mH$
$V_{dc} = 48$
$\omega = 2\pi 60$



a) $I_o = \frac{V_o - V_{dc}}{R} = \frac{\frac{2V_m}{\pi} - V_{dc}}{R} = \frac{\frac{2 \times 120\sqrt{2}}{\pi} - 48}{3} = 20\ A$

$P_{dc} = I_o V_{dc} = 20^{A} \times 48 = 961\ W$

$V_n = \frac{2V_m}{\pi} \cdot \left[\frac{1}{n-1} - \frac{1}{n+1} \right]$

$I_n = \frac{V_n}{|R + jn\omega L|}$

=>

n	V_n	I_n
2	72.2	36.15
4	14.4	0.63
6	6.17	0.18

$I_{rms} = \left[20^2 + \left(\frac{6.15}{\sqrt{2}}\right)^2 + \left(\frac{0.631}{\sqrt{2}}\right) + \left(\frac{0.18}{\sqrt{2}}\right) \right]^{\frac{1}{2}} = 20.5^{A}$

$P_R = I_{RMS}^2 \cdot R = (20.5)^2 \times (3) = 1.259^{W}$

c) $S = V_{rms} I_{rms} = \left(\frac{120}{\sqrt{2}}\right) \cdot (20.5) = 2460$, $PF = \frac{P}{S} = \frac{961 + 1259}{24600} = 0.9$

d) $\Delta I_o = 2 I_2 = 6.16 \times 2 = 12.32^{A}$

#4-20 $\begin{cases} V_s = 120^{V}\ (rms) \\ f = 60^{Hz} \\ R = 500 \end{cases}$

جریان پیک دیودها با هم هستند

در مدار تمام موج، خازن کوچک است، جریان متوسط دیودها

نصف نیم موج است

همچنین در نیم موج تعداد دیودها کمتر از تمام موج است.

#4-25 $\begin{cases} \text{RL Load} \nearrow R = 25 \\ \quad\quad\ \searrow L = 50^{mH} \\ V_s = 240^{V}\ (rms) \\ f = 60\ Hz \\ I_{avg} \nearrow \text{a) with } \alpha = 15^\circ \\ \quad\quad\ \searrow \text{b) with } \alpha = 75^\circ \end{cases}$

$\tau = \frac{L}{R} = \frac{50^{mH}}{25}$

$\tan^{-1}\left(\frac{\omega L}{R}\right) = 37.01^\circ > \alpha$

a) $\alpha = 15^\circ$: $i(\omega t) = \frac{V_m}{Z}\sin\left[\omega t - \theta\right] + Ae^{\frac{-\omega t}{\omega \tau}} = 10.84\sin\left(\omega t - 0.646\right) + 5.75\,e^{\frac{-\omega t}{0.75}}$

$i(\beta) = 0 \Rightarrow \beta = 217^\circ \Rightarrow \beta - 180 = 37^\circ > \alpha$

$V_o = \frac{2V_m}{\pi}\cos\alpha = 208.7$, $I_o = \frac{V_o}{R} = \frac{208.7}{25} = 8.35^{A}$

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b) $\alpha = 75^\circ$ $\quad \theta = \tan^{-1}\left(\frac{\omega L}{R}\right) < \alpha$

$i(\omega t) = \frac{V_m}{Z}\sin\left[\omega t - \theta\right] + Ae^{\frac{-\omega t}{\omega \tau}} = 10.84\sin\left(\omega t - 0.646\right) - 39.9\,e^{\frac{-\omega t}{0.75}}$

$i(\beta) = 0 \Rightarrow \beta = 216^\circ$ $\quad \beta - 180 = 36^\circ < \alpha$

$I_o = \frac{1}{\pi}\int_{\alpha}^{\beta} i(\omega t)\, d\omega t = \underline{2.3^{A}}$

#4-30 $\begin{cases} V_s = 240^{V}\ (rms) \\ f = 60^{Hz} \\ R = 10 \\ L = 0.8^{H} \\ V_{dc} = -100 \end{cases}$

$V_o = \frac{2V_m}{\pi}\cos\alpha = \frac{2\sqrt{2}\,(240)}{\pi}\cos 105^\circ = -56\ V.$

$I_o = \frac{100 - 56}{10} = 4.4^{A}$ $\quad P_{dc} = I_o V_{dc} = 4.4\,(100) = 440$

$P_{ac} = P_{bridge} = I_o V_o = 4.4\,(56) = 246^{W}$

$P_R = P_{dc} - P_{ac} = 440 - 246 = 194^{W}$

$\frac{V_2}{V_m} \approx 0.83$ for $\alpha = 105^\circ$

$V_2 = 0.83\,V_m = 0.83\sqrt{2}\,(240) = 281^{V}$

$Z_2 = |R + j2\omega L| = |10 + j2(377)(0.8)|$
$= 603 - R$

$I_2 = \frac{V_2}{Z_2} = \frac{281}{603} = 0.47^{A}$ $\quad \Delta I_o \approx 2 I_2 = \underline{0.94\ A}$

#4-33 a) $P_{dc} = 5^{kW} \Rightarrow P_{dc} = I_o V_{dc} = -5^{kW}$

$\Rightarrow I_o = \frac{-5000}{-150} = 33.3^{A}$

$V_o = -150 + 0.6 I_o = -150 + 0.6(33.3) = -130^{V}$

$V_o = \frac{2V_m}{\pi}\cos\alpha \Rightarrow \alpha = \cos^{-1}\left(\frac{V_o \pi}{2V_m}\right) = \cos^{-1}\left(\frac{-130\pi}{2\sqrt{2}(240)}\right) = 127^{\circ}$

b) $P_{bridge} = I_o(-V_o) = 33.3(130) = 4329^{W}$

c) $\frac{V_2}{V_m} \approx 0.73 \Rightarrow V_2 = 0.73(240)\sqrt{2} = 248^{V}$

$\Delta I_o = 0.1 I_o = 0.1\left[33.3\right] = 3.33^{A} \Rightarrow I_2 = \frac{\Delta I_o}{2} = 1.67^{A}$

$Z_2 = \frac{V_2}{I_2} = \frac{248}{1.67} = 149\,\Omega \approx 2\omega_o L$, $\quad L = \frac{149}{2(377)} = 0.197^{H} \approx 200^{mH}$

4-35 a) $V_o = \frac{3V_m}{\pi} = \frac{3\sqrt{2}(240)}{\pi} = 324$, $\quad I_o = \frac{V_o}{R} = \frac{324}{80} = 4.05^{A}$

b) $V_6 = \frac{6V_m}{\pi(6^2-1)} = 0.055 V_m = 0.055\sqrt{2}(240) = 18.5$

$Z_6 = R = 80\,\Omega$, $\quad I_6 = \frac{V_6}{Z_6} = \frac{18.5}{80} = 0.23^{A}$

$I_{rms} = \sqrt{I_o^2 + I_{6,rms}^2} = \sqrt{4.05^2 + \left(\frac{0.23}{\sqrt{2}}\right)^2} = 4.06^{A}$

c) $I_D = \frac{I_o}{2} = \frac{4.04}{2} = 2.02^{A}$ $\quad$ d) $I_{D,rms} = \frac{I_{o,rms}}{\sqrt{2}} = \frac{4.05}{\sqrt{2}} = 2.87^{A}$

e) $I_{s,rms} = \frac{I_{o,rms}\sqrt{2}}{\sqrt{3}} = \frac{4.06\sqrt{2}}{\sqrt{3}} = 3.31^{A}$

f) $P = I_{o,rms}^2 R = (4.06)^2 \cdot 80 = 1315^{W}$, $\quad S = \sqrt{3}\,V I = \sqrt{3}(240)(3.31) = 1376^{VA}$

$PF = \frac{P}{S} = \frac{1315}{1375} = \underline{0.956}$

#4-40

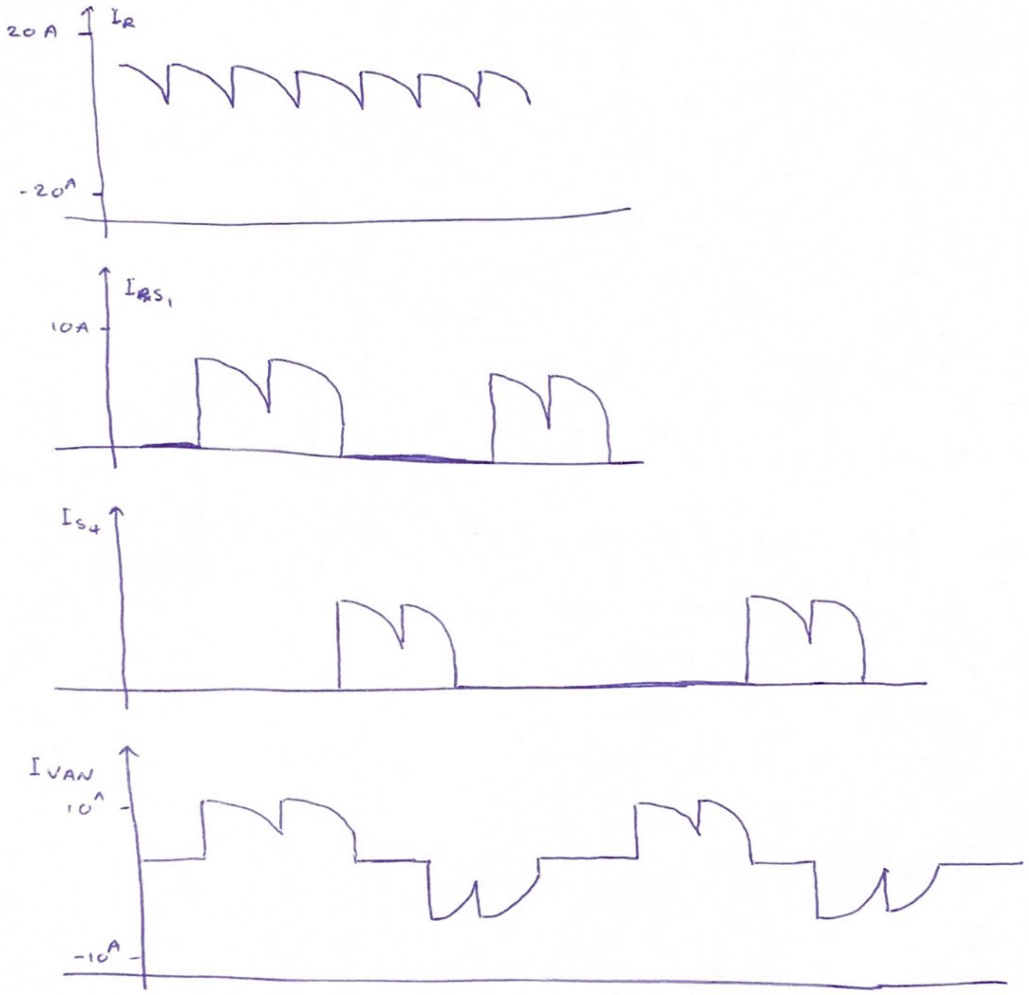
a) $V_o = I_o R = 10(50) = 500^V$

$$\alpha = \cos^{-1}\left(\frac{\pi V_o}{3V_m}\right) = \cos^{-1}\left(\frac{\pi \times 500}{3\sqrt{2}(480)}\right) = 39.5^\circ$$

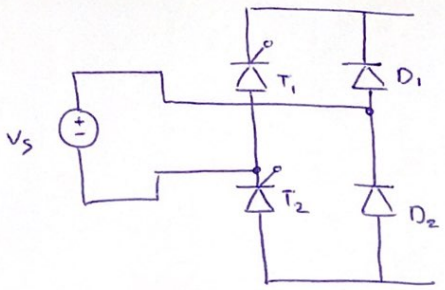
b) $\frac{V_6}{V_m} \approx 0.21 \Rightarrow V_6 = 0.21\sqrt{2}(480) = 143^V$

$\frac{V_{12}}{V_m} \approx 0.1 \Rightarrow V_{12} = 68$, $\frac{V_{18}}{V_m} \approx 0.07 \Rightarrow V_{18} = 48^V$

c)



#1



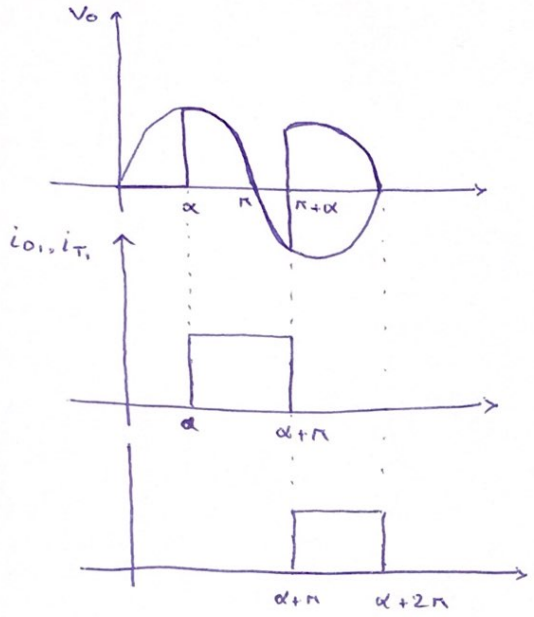
$I = 10^A$

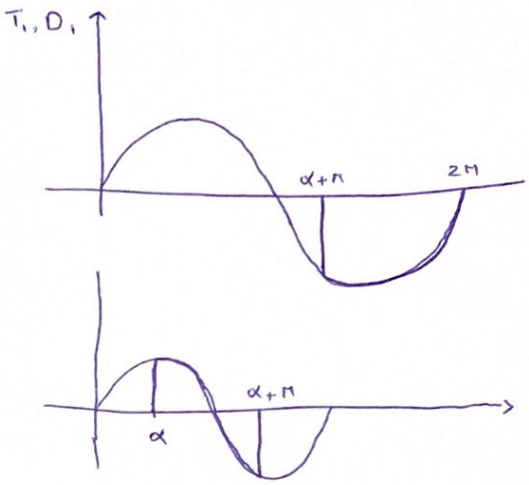
$V_s = 220^v$ (rms)

$f = 50^{HZ}$

$\alpha = 15 + 5K \xrightarrow{K=0} 15$

أ)





ب) $V_{T_1,D_1} = \frac{1}{2\pi} \int_{\alpha+\pi}^{2\pi} 220\sqrt{2} \sin wt \, dwt$ ، $V_{T_2,D_2} = \frac{1}{2\pi} \int_{15}^{220} 220\sqrt{2} \sin wt \, dwt$

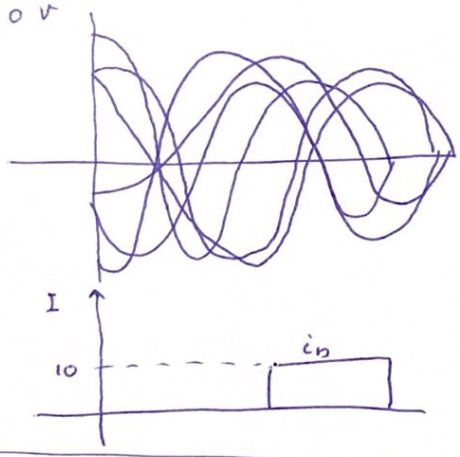
#2

$V_{L-L} = 380\ V$

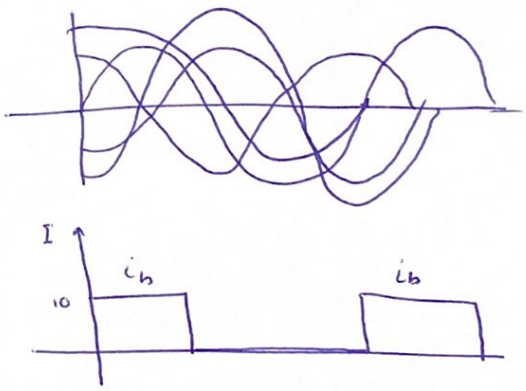
$f = 50\ HZ$

$I_L = 5^A$

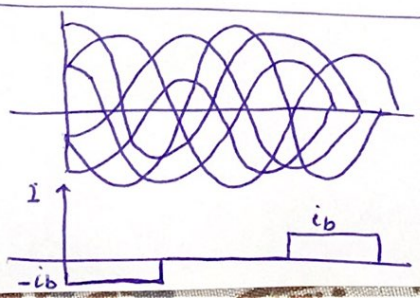
إذا $\alpha = 45^\circ$



$\alpha = 75^\circ$



$\alpha = 105^\circ$



$\alpha = 180^\circ$