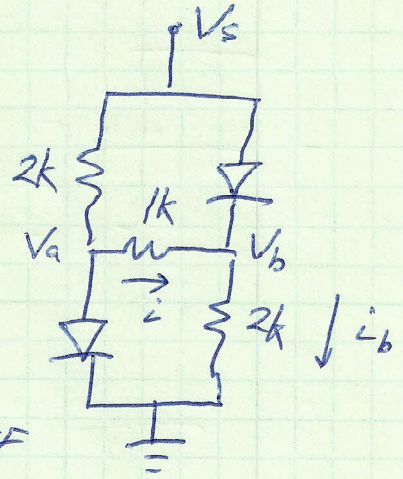
Question 1



a) $V_s = 1V$

assume both OFF

$$i = \frac{V_s}{5k} = \boxed{0.2mA}$$

$V_D = 0.6V$ → consistent with OFF

↖ $0.2mA \times 3k\Omega$

b) $V_s = 2V$

assume both ON

$$i = -\frac{V_s - 1.4V}{1k} = \boxed{-0.6mA}$$

$V_b = 1.3V \rightarrow i_b = \frac{1.3V}{2k} = 0.65mA$

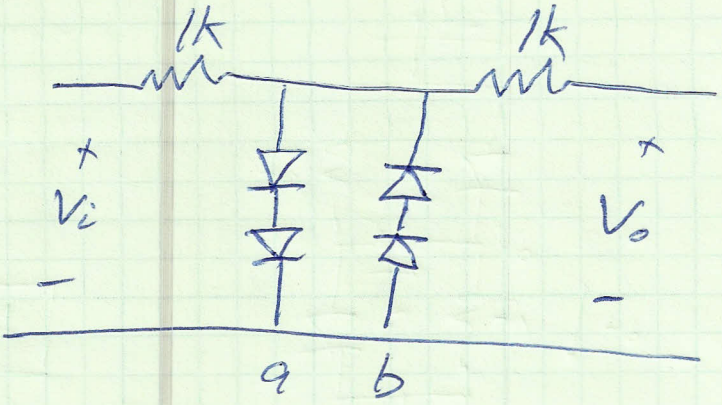
$V_a = 0.7V$

$i_D = i_b - i = 0.65 - (-0.6)$

$= 1.25mA > 0$

consistent with ON

Question 2



a) diodes in branch a are on when $V_i > 1.4v \rightarrow V_o = 1.4v$

diodes in branch b are on when $V_i < -1.4v \rightarrow V_o = -1.4v$

all diodes off when $-1.4v < V_i < 1.4v \rightarrow V_o = V_i$

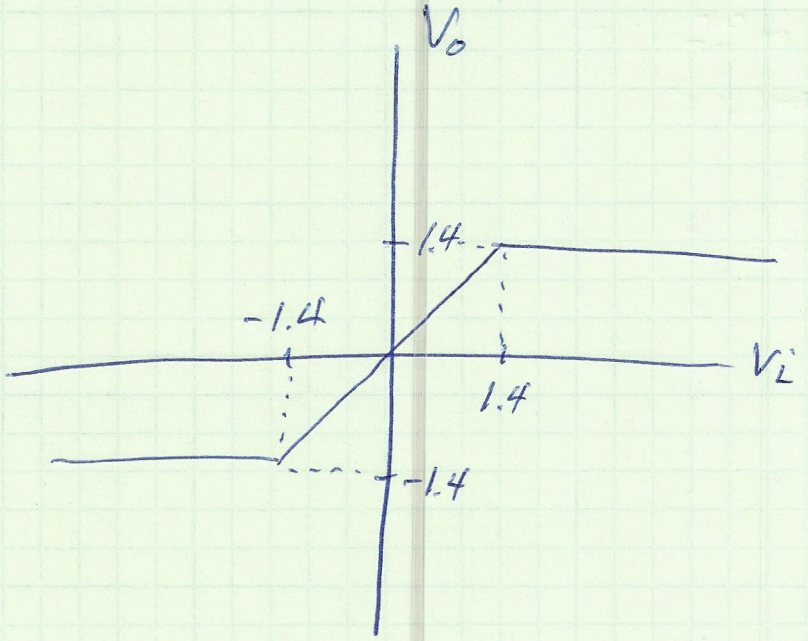
Transfer function:

for $V_i < -1.4v$, $V_o = -1.4v$

for $-1.4v < V_i < 1.4v$, $V_o = V_i$

for $V_i > 1.4v$, $V_o = 1.4v$

b)



Question 3

a) diode ON for $V_i < -0.7V \rightarrow i = \frac{V_i + 0.7V}{2k}$

$V_o = i \cdot 1k - 0.7V$

$V_o = \frac{V_i + 0.7V}{2} - 0.7V = \frac{V_i}{2} - 0.35V$

diode OFF for $-0.7V < V_i < 5V \rightarrow i = 0,\ V_o = V_i$

diode in Zener region for $V_i > 5V \rightarrow i = \frac{V_i - 5V}{2k}$

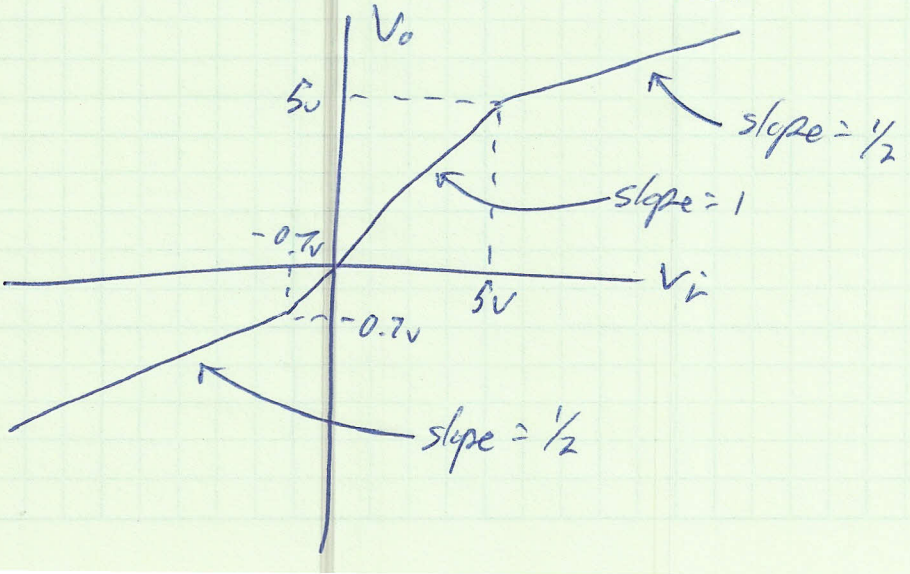
$V_o = i \cdot 1k + 5V$

$V_o = \frac{V_i - 5V}{2} + 5V = \frac{V_i}{2} + 2.5V$

Transfer function:

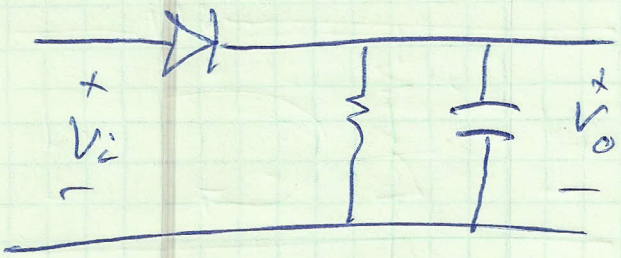
for $V_i < -0.7V$, $V_o = \frac{V_i}{2} - 0.35V$
for $-0.7V < V_i < 5V$, $V_o = V_i$
for $V_i > 5V$, $V_o = \frac{V_i}{2} + 2.5V$

b)



ECE65 | Quiz 1 | Spring 2012

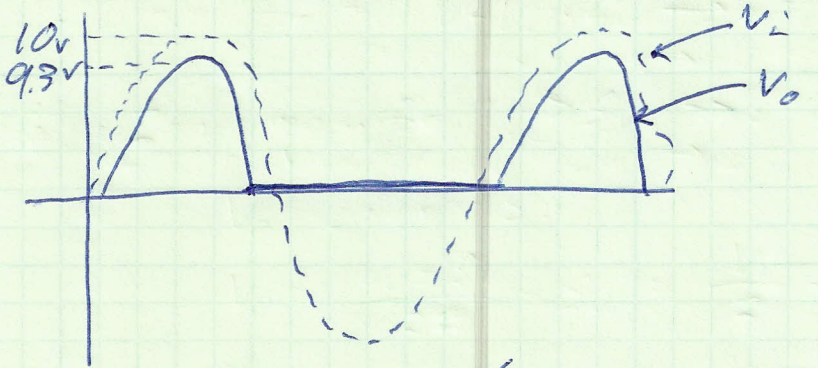
Question 4



1 MHz sine wave → $T = 10^{-6}$ sec (period)

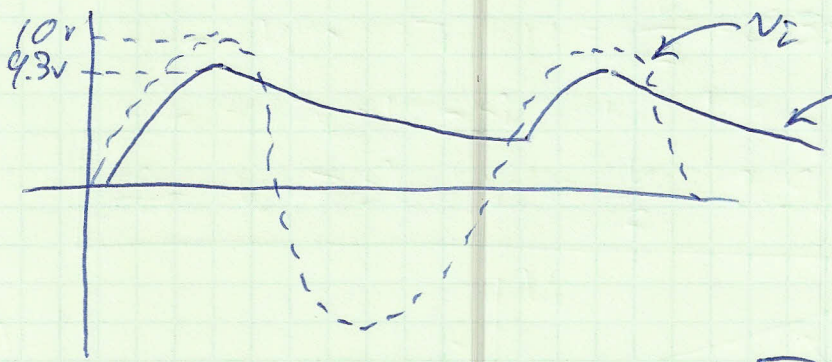
$\tau = RC$ = decay constant after charging capacitor

a) $R = 10\Omega$, $RC = 10^{-8}$ sec, $\tau \ll T$



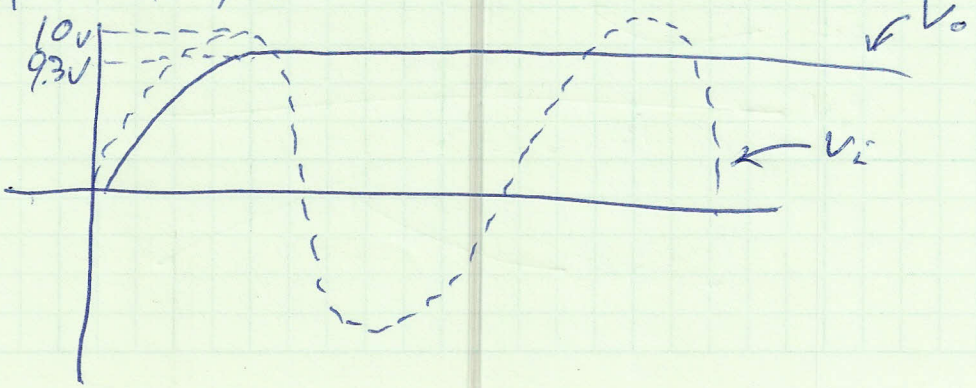
rectifier

b) $R = 1k\Omega$, $RC = 10^{-6}$ sec, $\tau = T$



ripple

c) $R = 100k\Omega$, $RC = 10^{-4}$ sec, $\tau \gg T$



peak detector