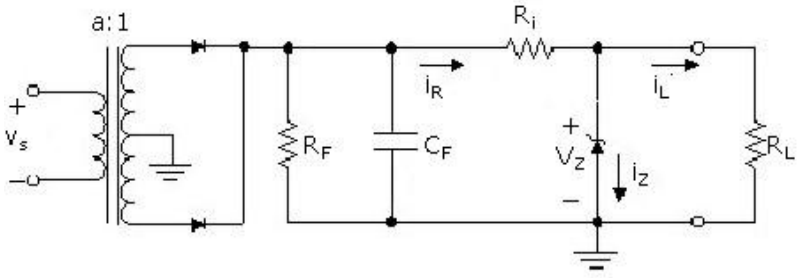
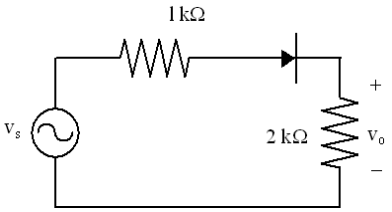
ETEE3211 Fall 2005 Test #1 Name:_____

Show all work. Clearly indicate final answer(s).

1. (50 pts) Assume no resistor, R_F, is used in the circuit below and the transformer is a 4:1 center tapped transformer with a 120Vrms 60Hz input. Assume the minimum voltage allowed at the regulator input is 14V:
   a. What value of R_i would be needed to maintain 10V across a load whose current varies from 50mA to 200mA?
   b. What value of capacitor is needed in the regulator in order to maintain a minimum voltage of 14V?

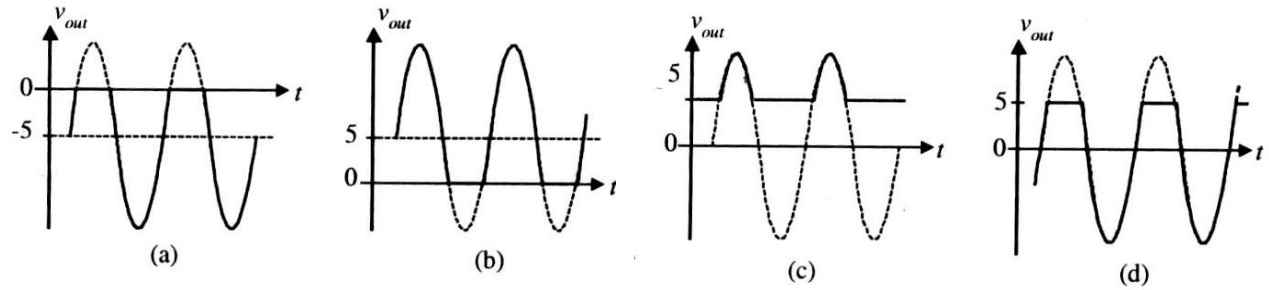


2. (30 pts) For the circuit to the right, sketch the output voltage, v_o, when the input voltage v_s=9sinωt V. Assume the V_{ON} of the diode is 0.6V and R_f=0.

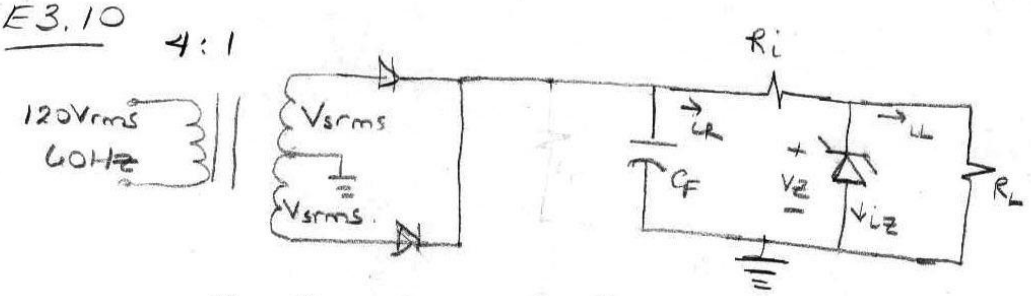


3. (20 pts) A silicon diode is placed in a circuit and is operating at 85°C. At 25°C, the diode has a 0.68V drop. What is the voltage drop of the diode when in the circuit?

Extra Credit: (20 points max) What type of circuit is needed to obtain the waveforms shown below? Assume the input is 10sint V. Draw the circuits and label them.



E3.10



want: R_i for $V_L = 10V$ $(= V_Z)$

given: $I_{Lmin} = 50mA$, $I_{Lmax} = 200mA$

$V_{smin} = 14V$

use (3.58) $R_i = \dfrac{V_{smax} - V_Z}{I_{Lmin} + I_{Zmax}}$

(3.61) $I_{Zmax} = \dfrac{I_{Lmin}(V_Z - V_{smin}) + I_{Lmax}(V_{smax} - V_Z)}{V_{smin} - 0.9V_Z - 0.1V_{smax}}$

$V_{smax} = \sqrt{2}\,V_{srms} = \sqrt{2}\left(\dfrac{120}{(4)(2)}\right) \cong 21.21V$

$I_{Zmax} = \dfrac{(0.05)(10-14) + (0.2)(21.21-10)}{14 - (0.9)(10) - (0.1)(21.21)} = 0.709A$

$R_i = \dfrac{21.21 - 10}{0.05 + 0.709} \cong \underline{\underline{14.8\,\Omega}}$

E3.11 want C_F so that $V_{smin} = 14V$

from E3.10: $R_i = 14.8\Omega$, $V_{smax} = 21.21V$, $V_Z = 10V$

use (3.62) $C_F = \dfrac{V_{smax} - V_Z}{\Delta V \, f_p \, R_i}$

$\Delta V = 21.21 - 14 = 7.21V$

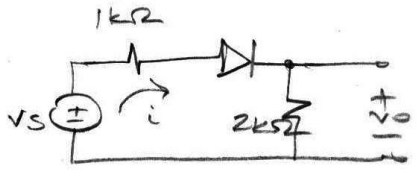
$f_p = 120Hz$ (full wave rectifier)

$C_F = \dfrac{21.21 - 10}{(7.21)(120)(14.8)} = 8.75 \times 10^{-4} F$

$C_F = 875 \mu F$

FOSTIP2

P3.9



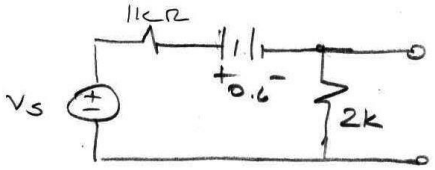
$v_s = 9\sin\omega t$ V

$V_{on} = 0.6$V

$R_f = 0$

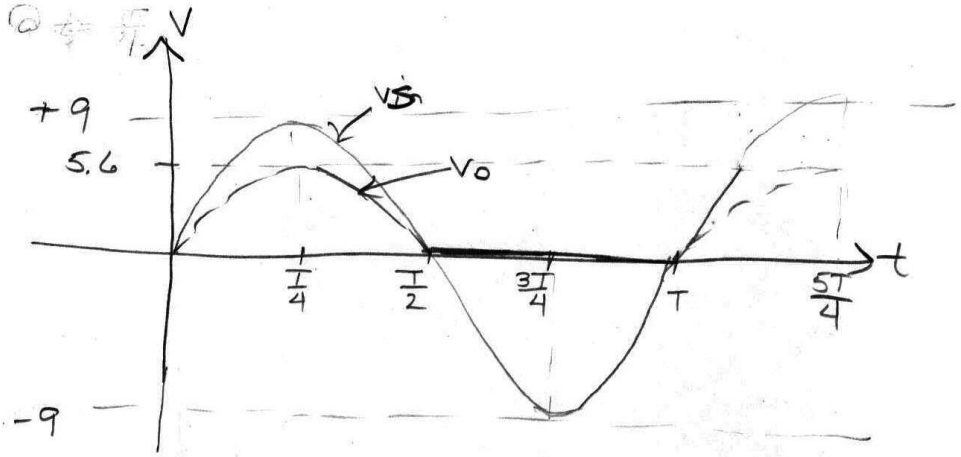
$v_s < 0$: diode open, $i = 0$, $v_o = 0$

$v_s \geq 0$: forward biased diode, $R_f = 0$



$V_{omax} = \frac{(9-0.6)2k}{2k+1k} = 5.6$ V

output tracks input, but is scaled.



EOST / P3

P3.3

Want: V_{on} @ $T = 85°C$

Given: $V_{on} = 0.68\,V$ @ $T = 25°C$

Use (3.32) where $T_{new} = 85°C$

$T_{room} = 25°C$

$k_T = -2\,mV/°C$ (Si)

$$V_{on}(85°C) - V_{on}(25°C) = k_T(85°C - 25°C)$$

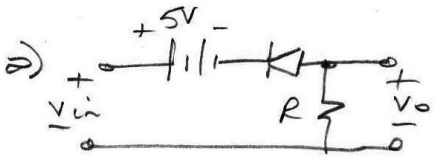
$$V_{on}(85°C) = 0.68 - 0.002(60)$$

$$V_{on}(85°C) = \underline{0.56\,V}$$

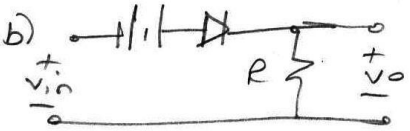
FOSTIEC

P3.44

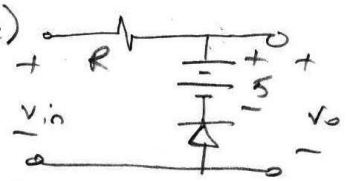
a)



b)



c)



d)