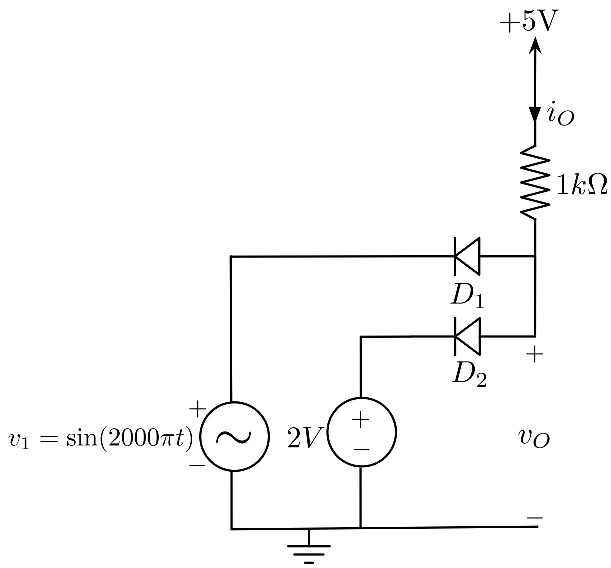
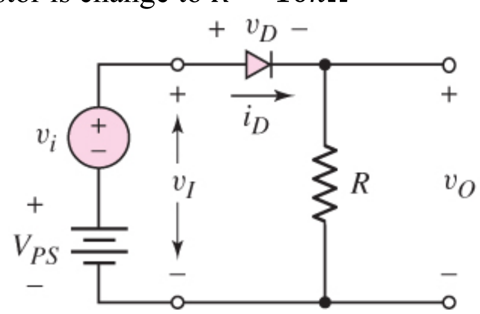
1- Find the voltage v_O and current i_O of the diode circuit shown in the figure below. You may assume a diode cut-in voltage of $V_\gamma = 0.7$V.



2- Consider the diode circuit shown below.

(a) If the diode and circuits parameters are $V_{PS} = 8$V, $R = 20k\Omega$, $V_\gamma = 0.7$V, and $v_i = 0.25\sin(\omega t)$ V, Determine the quiescent diode current and time-varying diode current.

(b) Repeat part (a) if the resistor is change to $R = 10k\Omega$



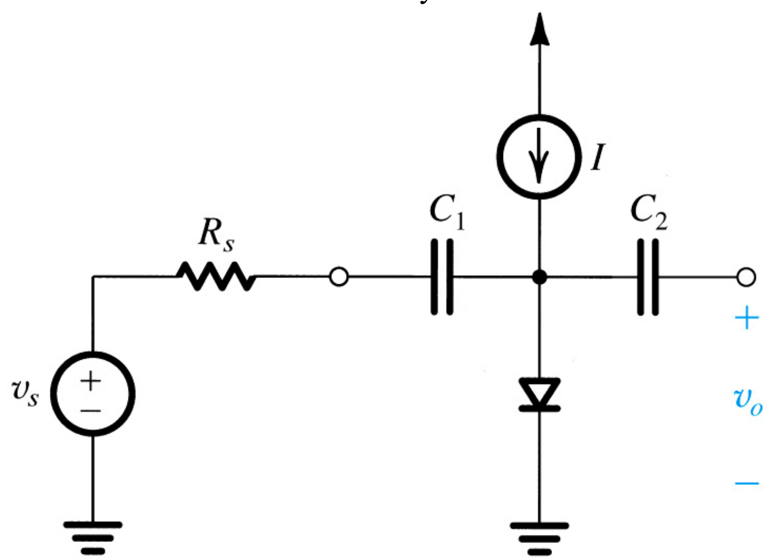
3- The reverse-saturation current of a pn junction diode and a Shottky diode are $I_s = 10^{-14}$A and 10^{-9}A respectively. Determine the forward-bias voltages required to produce a current of 100μA in each diode.

4- A pn junction diode and a Schottky diode have equal cross-sectional areas and have forward bias currents of $0.5m$A. The reverse-saturation current of the Schottky diode is $I_s = 5\times10^{-7}$A. The difference in forward-bias voltages between the two diodes is 0.3V. Determine the reverse-saturation current of the pn junction diode.

5- In the circuit shown below, I is a dc current and v_s is a sinusoidal signal. Capacitors C_1 and C_2 are very large; their function is to couple the signal to and from the diode but block the dc current from flowing into the signal source or the load (not shown). Use the diode small-signal model to show that the signal component of the output voltage is

$$v_o = v_s \frac{V_T}{V_T + IR_s}$$

If $v_s = 10mV$, find v_o for $I = 1mA$, $I = 0.1mA$, and $I = 1\mu A$. Let $R_s = 1k\Omega$ and $V_T = 2\times 25mV = 50mV$ (Note: The factor of 2 here is to account for the emission factor) At what values of I does v_o become one-half of v_s? Note that this circuit functions as a signal attenuator with the attenuation factor controlled by the value of dc current I.

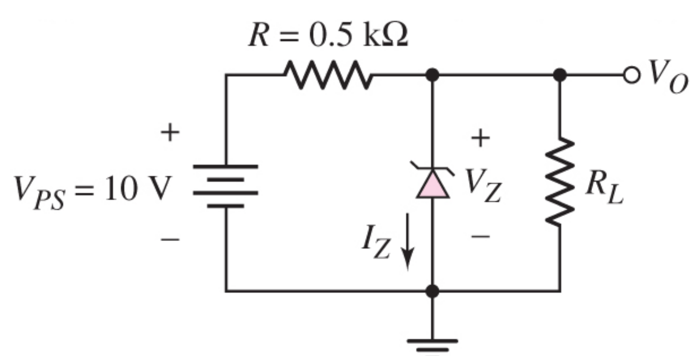


6- Consider the Zener-diode circuit shown in the Figure below. The Zener breakdown voltage is $V_Z = 5.6V$ at $I_z = 0.1\ mA$, and the incremental Zener reverse resistance is $r_z = 10\,\Omega$.

(a) Determine V_O with no load ($R_L = \infty$).

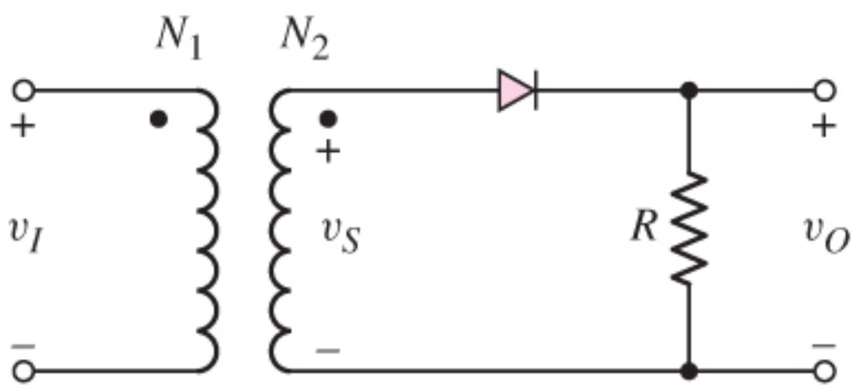
(b) Find the change in the output voltage if V_{PS} changes by $\pm 1V$.

(c) Find V_O if $V_{PS} = 10V$ and $R_L = 2k\Omega$.



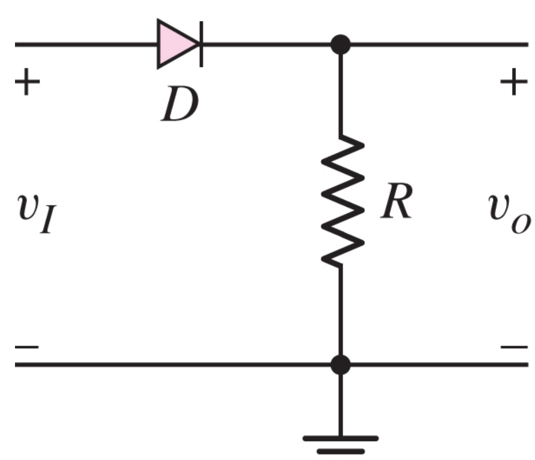
7- Consider the half-wave rectifier shown below. The input voltage is $v_I = 160\sin(2\pi \times 60t)$ V and the transformer turns ratio is $\frac{N_1}{N_2} = 6$. If $V_\gamma = 0$V and $r_f = 0$, determine

(a) the peak diode current
(b) the value of Peak Inverse Voltage (PIV)
(c) the average value of the output voltage v_O
(d) the fraction (percent) of a cycle that $v_O > 0$.
(e) Repeat parts (a)-(d) when $V_\gamma = 0.7$V



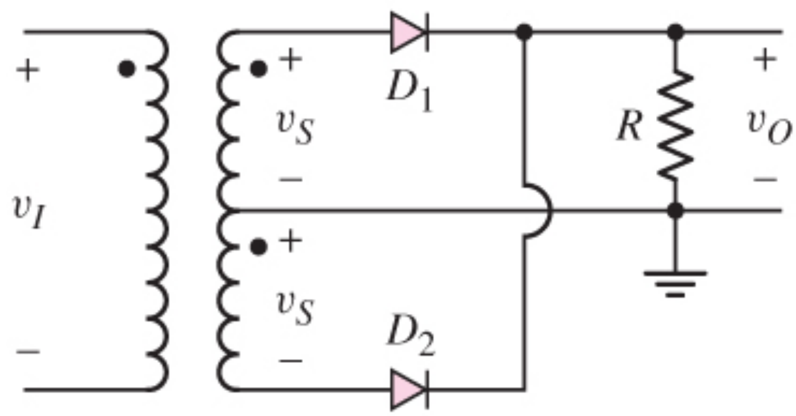
8- Assume the input to the circuit shown below is a triangular wave of 20 V peak-to-peak amplitude with zero time-average value. Let $R = 1k\Omega$ and assume piecewise linear diode parameters of $V_\gamma = 0.6$V and $r_f = 20\Omega$.

(a) Sketch the input and output voltages versus time over one cycle and label all appropriate voltages.
(b) Determine the peak diode current and value of the PIV
(c) Repeat part(a) and (b) for the case when the polarity of the diode is reversed.



9- The full-wave rectifier circuit shown in the figure below is to deliver 0.2A and 12V (peak values) to a load. The ripple voltage is to be limited to 0.25V. The input signal is 120V (rms) at 60 Hz. Assume diode cut-in voltages of 0.7V.

a. What is the name of this full-wave rectifier circuit?
b. Determine the required turns ratio of the transformer.
c. Find the required value of the capacitor
d. What is the PIV rating of the diode?



10- The input voltage to the full-wave rectifier circuit in the figure below is $v_I = 160\ \sin(2\pi\times 60t)$ V. Assume $V_\gamma = 0.7$V for each diode.

a. Determine the required turns ratio to produce a peak output voltage of
   i. 25 V
   ii. 100 V
b. What must be the diode PIV rating for each case in part (a)?