March 5, 2024

ECEN 325

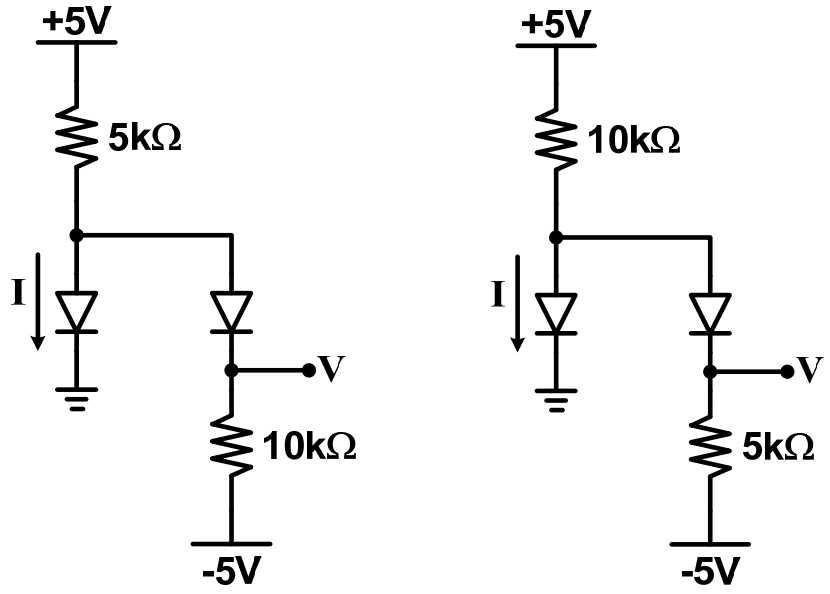
Homework #4

Due: March 21, 2024, 11:59PM

Homeworks will not be received after due.

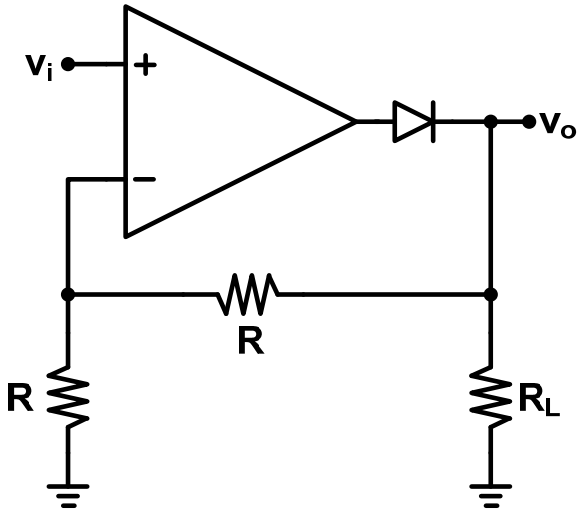
Instructor: Sam Palermo

1. **(20 points)** For the 2 following circuits solve for the labeled current *I* and voltage *V*. Use the constant-voltage-drop diode model (V_D=0.7V).

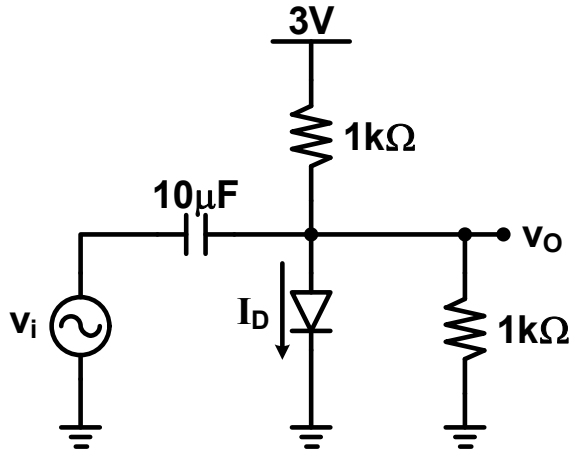


(a) (b)

2. **(20 points)** In the following circuit, the op-amp is ideal **except that the op-amp output saturates at ±6V**. Sketch the circuit's transfer characteristic, v_o vs v_i, for v_i ranging from ±10V. Use the constant-voltage-drop diode model (V_D=0.7V).



3. **(20 points)** For the circuit below:
   a) Find the DC diode current (I_D) and the DC output voltage (V_O).
   b) Find the small-signal AC transfer function $v_o(s)/v_i(s)$. Assume n=1 for the diode.
   c) Find the total output voltage $v_{O,total}$ for $v_i(t)=0.001\sin(2\pi*10^5 t)$.



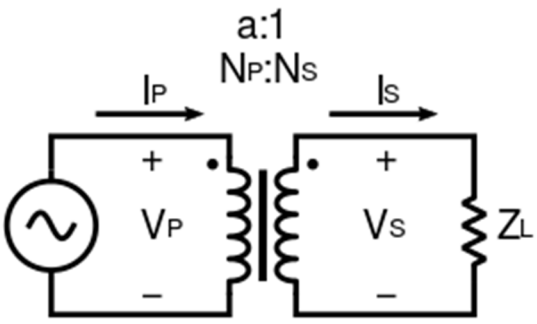
4. **(40 points)** Design an AC adapter with the following specifications using a single-ended transformer. Choose an appropriate rectifier to minimize the capacitance.

Input voltage:	$120V_{rms}$, 60Hz
Output voltage:	5V
Maximum ripple:	5%
Load current range:	0-500mA

Determine the minimum specs for the diode (I_P, reverse breakdown voltage), primary/secondary ratio (N_P/N_S) of the transformer, and the load resistor and capacitor value.

Recall for a sinusoidal signal: $V_{rms} = \frac{V_P}{\sqrt{2}}$

Also, for a transformer



[Wikipedia]

$$\frac{V_P}{V_S} = \frac{I_S}{I_P} = \frac{N_P}{N_S}$$