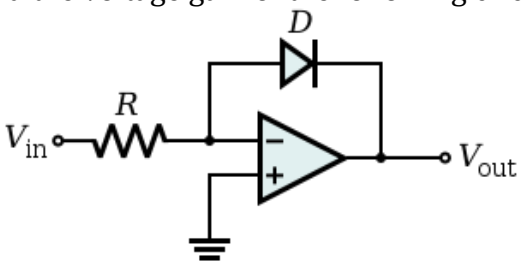
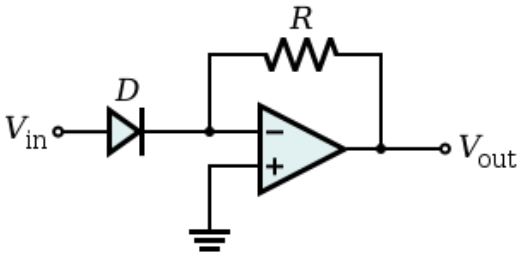
HW#4
(Submit to bCourses by 11 pm on 2/22)

1) A semiconductor is doped with As with an exponential profile:
   $N_D(x) = N_0 e^{-\frac{x}{d}}$ for $x > 0$, where $N_0 = 10^{18} cm^{-3}$ and $d = 1\mu m$.
   a) Derive the analytical expression of the electrical field in the region $x > 0$.
   b) Find the magnitude of the electrical field at $x = 1\mu m$.
   c) What is the direction of the electric field?
   d) What is the direction of drift current? What is the direction of the diffusion current?

2) Find the voltage gain of the following circuits. Treat the Op amp as ideal.

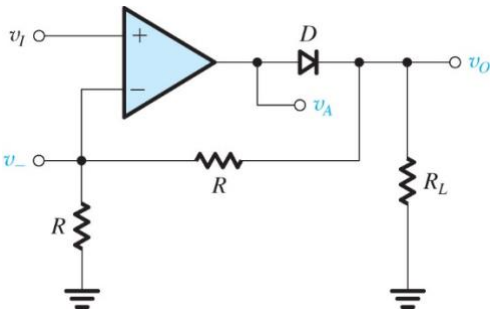


a)



b)

3) The op amp in the precision rectifier circuit show below is ideal with output saturation levels of +/- 13V. Assume that when the conducting the diode exhibits a constant voltage drop of 0.7V. Find v_- , v_o , and v_A for:
   a) $v_I = +1V$
   b) $v_I = +3V$
   c) $v_I = -1V$
   d) $v_I = -3V$
   e) Find the average output voltage obtained with v_I is a symmetrical square wave of 1kHz frequency, 5V amplitude and zero average.



4) For the circuit below, both diodes are identical. Find the value of *R* for which V = 50 mV.