

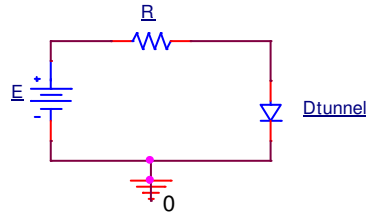
303H Fall 2016 – Homework 2 Due Tu 09/20/16

1. (60 points, Q points and load lines)

The following circuit has the (tunnel like) diode described by the cubic law

$$i_D = I_D + G_d(v_D)(v_D-1)(v_D-2) \text{ where}$$

$$I_D=2\text{mA and } G_d=1\text{ma/V}^3.$$



- Plot the diode curve, i_D versus v_D for $-1 < v_D < 3$ Volts.
 - Find the local maximum V_{Dmax} (with v_D in $[0, 1]$) and local minimum V_{Dmin} (with v_D in $[1, 3]$) and give the value of i_D at these two voltages.
 - Assume $E=2V_{Dmin}$ and $R>0$. Give a range of R so that there is a Q point in the negative slope region.
 - Bias the diode so that the Q point is at $V_D=V_{Dmax} + (1/2)(V_{Dmin}-V_{Dmax})$.
 - Plot the diode curve and load line together for this Q point and explain any strange behavior you think will result in the operation.
 - Give the small signal conductance at the Q point.
 - Give the value of this conductance if the Q is moved to V_{Dmax} and again to V_{Dmin} .
2. (40 points, BJT hybrid-pi models)
- For this problem use transistor data from their data sheets
- Give the hybrid pi model for the 2N3904 npn transistor biased in the forward active region with $I_C = 3\text{mA}$.
 - Repeat for the 2N3906 pnp transistor at $I_C = -3\text{mA}$.
 - Comment on and explain any differences.