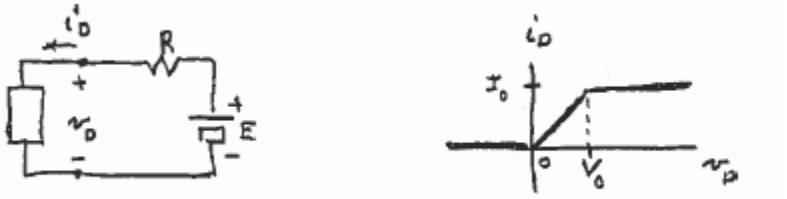
File: H:/coursesF15/303H/303HF15Hmwk2.doc RWN 09/10/15

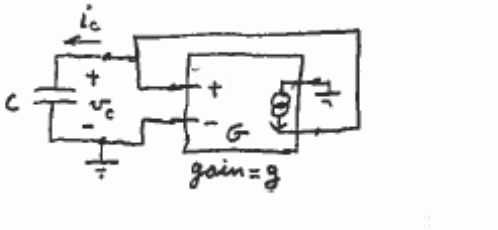
303H Fall 2015 – Homework 2 Due Th 09/17/15

1. (50 points, Q points and load lines)
   The following circuit has the 1-port diode described by the piecewise linear curve shown



   a) Assume E>Vo>0 and R>0. Give a range of R to the Q point is in the positive slope region; repeat for the Q point in the constant current =Io region. Draw separate graphs for typical load lines on the diode curve for each of the two cases.
   b) Give the small signal conductance in the above two regions. Explain what happens if Q is at the two break points, vD=0 & Vo.
   c) Next assume that E<0 and R<0. Pictorially with three different graphs show that there are one, two or three (that is, multivalued) Q points and discuss what you think this means.
   d) As the diode characteristic is piece-wise linear it can be written in one formula as a sum of unit-step functions with coefficients. Obtain such a representation.

2. (50 points, Spice G and load line)



   a) Set up the differential equation for the above circuit which uses the G (=VCCS) component of Spice. Solve the differential equation for t>0 when the capacitor initial condition is Vc(0)>0 and again when Vc(0)<0. Assume that C>0 and g>0. But note even though the G component gain may be positive its input resistance can be negative. G components can though have negative gains,
   b) Chose some reasonable values and run Spice for this circuit submitting your results.