File: H:/coursesS19/303/303S19Hmwk1.doc RWN 01/30/19

303 Spring 2019 – Homework 1 Due 02/07/19 see 02/05 corrections

Note: The 1N4007 diode Spice model the diode library in the path Cadence/SPB_17.2/tools/capture/library/pspice ad is on the course web page and copied here as:

```
.MODEL D1n4007 d
+IS=7.02767e-09 RS=0.0341512 N=1.80803 EG=1.05743
+XTI=5 BV=1000 IBV=5e-08 CJO=1e-11
+VJ=0.7 M=0.5 FC=0.5 TT=1e-07
+KF=0 AF=1
```

1. (50 points, diode DC curves)

a) In Spice do a DC run to get the DC diode curve of diode current, iD, versus diode voltage, vD, for the 1N4007 diode, submitting your curve. Run the curve over the diode voltage –0.8V to +0.8V. The model should be in the PSpice diode library under D1n4007 but if not found use a Breakout diode with the above model.

b) Repeat the curves for the pnp transistor 2N3906 formed into a diode by connecting the collector to the base. This transistor is found in the PSpice bipolar library under Q2N3906 ~~Q2N3904~~.

c) Repeat part b) but with the diode formed by connecting the emitter to the base.

d) Comment on differences and why they come about.

, VT

2. (50 points, Diode DC curves).

For the analytic DC diode equation $I=IS(e^{(V/VT)} -1)$

a) Use any mathematical program (MathCad, MatLab, Mathematica) and plot this equation for IS which is that of the 1N4007 at room temperature, VT=36mV, over the range -1<V<0.8 Volts.

b) Compare any difference between the above Spice run using the above model for the 1N4007 and discuss any differences.

c) Analytically find the derivative dI/dV and plot under the same conditions. The curve is of the small signal diode conductance, g.

d) Analytically solve for V vs I and repeat parts a) and c) for V vs I and dV/dI over the range of current I obtained in part a). The derivative curve, dV/dI, is the small signal diode resistance, r. Compare the small signal resistance with 1/g.

e) Draw a tangent to the I vs V curve which intersects the V axis at 0.6V and ones at 0.65V and 0.7V and compare their slopes.