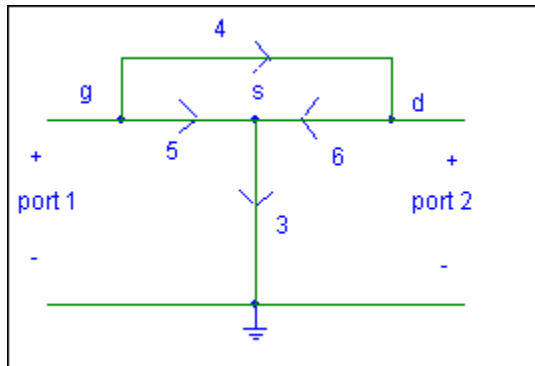


ENEE 610  
Homework Problems for Grading, Set 2 (100 points)  
Due at class M 09/25/06  
Equations via graph theory and two-port parameters

1.(50 points)

For the following circuit number the branches with the numbers given along with a current sources at ports one & two as branches 1 and 2.

- Choose branches 1, 2 & 3 as tree branches and find the cut set and tie set matrices. The nodes are named g, s, d (in preparation for problem 2 below).
- Assume the  $i$ th branch has an admittance,  $y_i(s)$ . Give the branch by branch admittance and find the  $3 \times 3$  admittance matrix which multiplies the tree branch voltages to give the tree branch currents.
- Assume that the branch admittances are all equal of value  $y(s) = Cs$ . Eliminate the internal node voltage (that is, the one at the top of branch 3) to determine the 2-port Y and Z matrices.
- Check the results by noting that there are two different 2-ports in parallel and calculating, and adding, their Y matrices.
- Place a load capacitor,  $y_L(s) = C_L s$ , on the second port and find the input admittance as well as the voltage transfer function  $V_2(s)/V_1(s)$



2.(50 points)

Repeat all of the above problem assuming that nodes g, s, and d represent the small signal equivalent circuit gate, source, and drain of an MOS transistor of parameters  $g_m$ ,  $g_o$ ,  $C_{gs}$ ,  $C_{gd}$ . For branch 3 assume a resistor of conductance  $g_s$ .