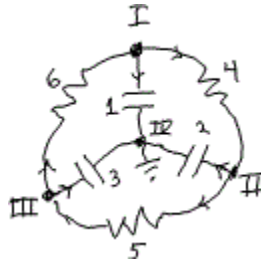EE 610 Final Exam Fall 2016
Open Book Open Notes 150 points, 2 hours.
Notebooks are due at the end of the exam. Good luck and have a good semester break.

1. (60 points, 40 minutes)

        The above "wheel of circuit" has all resistors equal of resistance $R=1/G$ and all capacitors of capacitance C. The nodes are numbered I, II, III, IV, the branches 1, 2, 3, 4, 5, 6, and directions are as given by the arrows.
        a) Use the capacitor branches as the tree and give the cut set and tie set matrices.
        b) Give the branch by branch admittance matrix.
        c) Excite by a current source connected from node IV into node I. Take as output the voltage at node I with respect to node IV. For these choices give the semi-state equations.
        d) Give the steps you would use to find the impedance seen by the input current source of part c).

2. (60 points, 40 minutes)
            Consider the input impedance $z(s) = [(s^2+1)(s^2+a)] /[s(s^2+4)]$
    a) For what values of a is this a lossless PR function?
    b) Give a 1st Foster synthesis for all a for which z(s) is PR.
    c) For any synthesis of z(s) replace every inductor by a capacitor of the same element value and vice versa (for example, Lnew=Cold). Give the resulting impedance $z_{new}(s)$.

3. (15 points, 10 minutes)
        For the impedance of problem 2 find the sensitivity of z(s) to the parameter a.

4. (15 points, 10 minutes)
        Without calculations draw the cascade synthesis of z(s) which would result from iterated use of the Richards' function. Justify your choice for load.