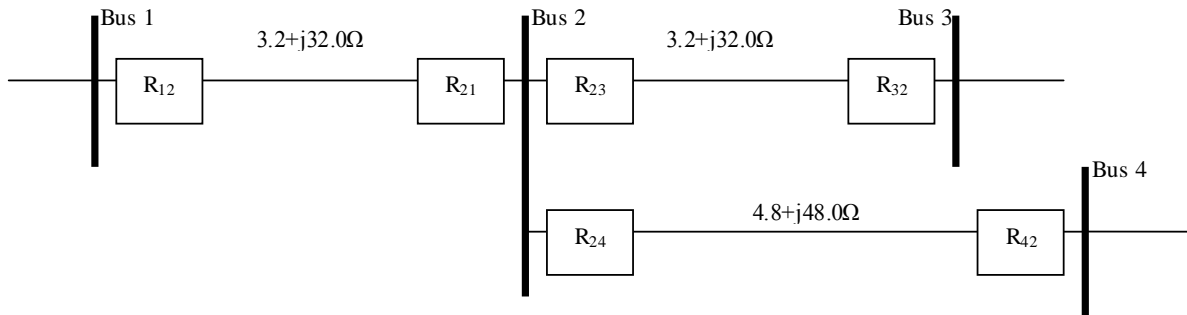# HW #5, Due Tuesday, March 3, 2015

A. **From Text, 13.1-13.5**

B. **Work the following problem:**

Consider the 138 kV transmission system.

The relays are impedance relays with directionality.

(a)   Select the CT ratio so that maximum load current provides 5 amperes on the relay side. Choices are I:5 where I may be 50, 100, 150, 200, 250, 300, 400, 450, 500, 600, 800, 900, 1000, or 1200.

(b)   Select the VT ratio V:1 so that the rated line-to-neutral voltage provides 67 volts on the on the relay side.

(c)   If the primary (line) side of the relay sees an impedance of $V_p/I_p=Z_{line}$, determine an expression for the impedance seen on the relay side, Z_{relay}, as a function of Z_{line} and the CT and VT ratios.

(d)   Identify zone 1, 2, and 3 settings for R12, i.e., the threshold impedance values, on the relay side corresponding to 80% of line 1-2 (zone 1), 120% of line 1-2 (zone 2), 120% of the longest line beyond bus 2 (zone 3) which would be line 2-4 in this case.

(e)   Draw zone 1, 2, 3 circles on R-X diagram; plot the point corresponding to maximum cct.1-2 load of 50 MVA, 0.8 pf lag.