

**Georgia Institute of Technology
School of Electrical and Computer Engineering**

EE4321

Power System Engineering

Spring 2009

**Homework Assignment #7
Due April 23, 2009**

Problem P1: Obtain a copy of the IEEE Std C37.2-1996, "IEEE Standard Electrical Power System Device Function Numbers and Contact Designations".

Provide the functional description of the following devices (a couple of sentences will suffice – you are encouraged to avoid copying the standard and to use your own words):

21
24
27
32
40
46
47
50
51
59
81
87

Problem P2: A single phase 6.92 kV/277V, 750 kVA, 60 Hz transformer is protected with a differential relay that uses the following current transformers: Primary: 120:5 and secondary: 3000:5. Compute the current in the operating coil of the differential relay as a function of the transformer current in the secondary, assuming ideal CTs.

Problem P3: Consider the 132 MVA, 18kV / 230kV, $z = j0.08 pu$ three phase, delta-wye connected variable tap step-up transformer indicated in Figure P3. This transformer is protected with a differential relay. The delta side is the 18 kV side. The settings of the relay are: 5% restrain, minimum pickup 0.5 Amperes. The CTs are 100:5 and 1800:5 for the high voltage side and low voltage side respectively. The high voltage side CTs are connected delta and the low voltage side CTs are connected wye.

The transformer is connected to a 220 MVA, 18 kV, 60 Hz, impedance grounded (ground impedance is $j5$ ohms) generator with the following parameters: $z_1 = j0.20 pu$, $z_2 = j0.18 pu$, $z_0 = j0.11 pu$ @ 18kV and 220MVA

Consider a single line to ground fault on the 230 kV side of the transformer outside the transformer zone of protection. For this condition (a) Compute the electric current in the three operating coils of the relay. (b) Determine whether the differential relay will trip the transformer.

Hint: Use the program WinIGS to compute the fault currents.

