EEL 451 (POWER SYSTEM PROTECTION)
MAJOR EXAMINATION – 5th May 2009

Time : 02 Hours F.M. : 80

1. (a) In a 132 kV , 3 phase, 50 Hz power system the line to ground capacitance is 0.02 μF and the inductance is 4.5 H. Determine the voltage appearing across the CB pole when a magnetizing current of 5A (instantaneous value) is interrupted. Also find the resistance to be connected across the CB contacts to eliminate the restriking voltage.

   (b) Explain the working principle of a static Over current relay [4 + 6]

2. (a) Explain the working principle of a balanced beam type electromechanical distance relay
   (b) Mention the duality between the Amplitude comparator and Phase comparator. Prove this duality taking into consideration a static simple Impedance relay.
   (c) Explain in detail with suitable mathematical derivation how a ground fault distance relay takes a trip decision. [7 + 10 + 8]

3. (a) Explain the working principle of the phase fault (say AB fault) directional relay with a proper choice of the input signals to the relay with justification.
   (b) Explain how a ground fault directional relay is polarized with a neat sketch [6 + 4]

4. (a) Explain the stator inter-turn protection scheme? [3 + 7 + 5]
   (b) A 13.8 kV , 150 MVA star connected alternator has asynchronous reactance of 1.68 per unit per phase and a negligible resistance. It is protected by a Merz – Price balanced current protection scheme which operates when the out-of-balance current exceeds 10% of the full load current. If the neutral point is earthed through a resistance of 2.5 ohm, determine what portion of the winding is protected against earth fault.
   (c) Explain the two ended Negative sequence impedance method of fault location

5. (a) Explain why the current transformer ratios have to be identical for the Bus bar differential scheme [3 + 7 + 5 + 5]
   (b) Explain the setting of the bus bar differential relay taking into consideration of external faults with the CT equivalent circuit
   (c) Explain Mann and Morrison algorithm.
   (d) Explain frequency resolution of DFT. What are the factors that affect the frequency resolutin