BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
M. E (EE) 2nd SEMESTER EXAMINATION 2012
POWER SYSTEM PROTECTION
(EE-1015)

Time: 3 Hours   Full Marks: 70

<u>Two marks are reserved for neatness in each group</u>
<u>All questions carry equal marks</u>
GROUP-A

<u>(Answer Q.No. 1 and any three from the rest)</u>

1. What happens when (any four)
   a) Generator Earth Fault relay operates
   b) Low Forward Power relay operates.
   c) All P.A fan trip.
   d) Both F.D fan trip.
   e) Bearing Oil Pressure Low.
   f) Unit Transformer Oil Temperature High.
      Annunciation appears in the annunciation panel. Justify your answer with the help of Logic diagram and state the status of GLR,TLR and MFR in each case.

2. a) 'Mho relay is very fast acting"- Justify. Explain the simplified theory of Polarised Mho relay.   [3+2]
   b) Derive the polarizing voltage for Earth fault relay element.   [6]

3. a) Derive the general characteristic equation of asymmetric comparator. Obtain the straight line characteristic from the generalized theory.   [3+4]

   b) Establish the theory of Duality between phase and amplitude comparator.   [4]

4. a) Derive the expression of flux variation in the core of a current transformer. State the effect of secondary resistance on D.C flux swing..   [3+2]

   b) What is Power Swing? What type protection is provided against power swing? Explain one such method.

                                                                              [2+2+2]
5) a) Derive the input quantities necessary to develop i) directional relay, ii) ohm relay characteristic by using rectifier bridge type amplitude comparator.   [5]
   b) Obtain i) Restricted directional and ii) Restricted reactance relay characteristics by using 90° phase comparator.   [6]
6 a) Explain the principle of operation of multi-input co-incidence comparator. Name different types of co-incidence type phase comparator.   [3+2]
   b) Explain : i) Pulse comparison and ii) Phase splitting techniques.   [3+3]

7.Draw the sub systems of a relaying computer and define each block.   [11]

8.The loss of excitation relay for generator checks for the R-X trajectory satisfying the mho relay characteristic, using proper signal processing techniques to final R & X.

   a) How will you find the value of R & X from the input signals of current and voltage?   [3]

   b) Draw the signal processing hardware layout for realizing the above loss-of excitation relay using a microcomputer.   [8]

9 a) What do you mean by sliding data window in signal processing.?   [3]
   b)   Which signal processing algorithm you would follow to find out fault conditions in an electric machine ? Justify   [4]
   c)Why is the principle of orthogonality followed in power system signal processing?   [4]

10 Write short notes on (any two)   [5½ x2]

   a)   Vertical hierarchical control in substation automation.
   b)   Travelling wave relaying
   c)   Wide Area Monitoring system.