EEL 451 (POWER SYSTEM PROTECTION)
MAJOR EXAMINATION

Time : 02 Hours Dt 07/05/2007. F.M. : 80

1. (a) Explain with suitable mathematical derivation the CT saturation for a fault current having a decaying dc component
   (b) In a 220 kV system, the reactance and capacitance up to the location of CB is 8 Ω and 0.025 μF respectively. Determine the critical value of the resistance which will give no transient oscillation and the value of the resistance which will give a damped frequency of oscillation, one-fourth of the natural frequency of oscillation
   (c) Define CT accuracy and different class of CTs. [6 + 4 +2]

2. (a) What are the ranges of PSM for phase fault relays and earth fault relays
   (b) Draw the neat circuit diagram for
      (i) combined earth fault and phase fault relaying scheme
      (ii) directional earth fault relaying scheme
   (c) What is Arcing ground ?
   (d) Draw and explain the operating characteristics of percentage biased differential relay for the protection of transformer for both internal fault and through fault condition. [2 + 4 + 2 + 6]

3. (a) What is an OHM relay ? How the characteristics of OHM relay is realized by
      (i) Electromagnetic type relay
      (ii) Static relay (both amplitude and phase comparator)
   (b) A CB is rated as 1500A, 1500 MVA, 33 kV, 3 secs, 3 – phase Oil Circuit Breaker
      Calculate (i) Rated Symmetrical Breaking Current
      (ii) Rated Asymmetrical Breaking Current (If Dc component at the time of breaking is 1% of maximum value of Ac component
      (iii) Rated Making current
      (iv)Short time rating
   (c) Explain with suitable example why the CT ratios have to be identical for the bus bar differential scheme ? [4 + 3 + 5]

4. (a) What is pilot relaying scheme ?
   (b) An 11 kV , 100 MVA alternator is to be provided with differential protection. The percentage of winding to be protected against phase to ground fault is 85%. The relay is set to operate when there is 20% out of balance current. Determine the value of the resistance to be placed in the neutral to ground connection.
   (c) Why it is important to remove the dc component from the fault current signal ?
   (d) What is the necessity of neutral earthing ? What is resonant grounding? [2 +5 +1+5]

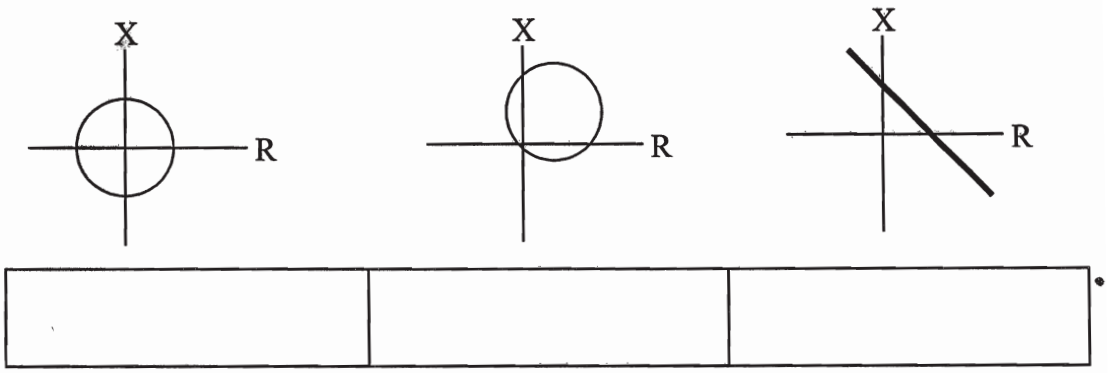
5. (a) How can the apparent impedance of a line from the relay location to the fault point is calculated using differential equation algorithm representing the transmission line model. State the possible errors in this scheme.
   (b) Explain the use of ground wire.
   (c) Describe various types of lightning arrestors used in substations.
   (d) Explain how the performance of a distance relay is affected by power swing? [5+2+3+4]

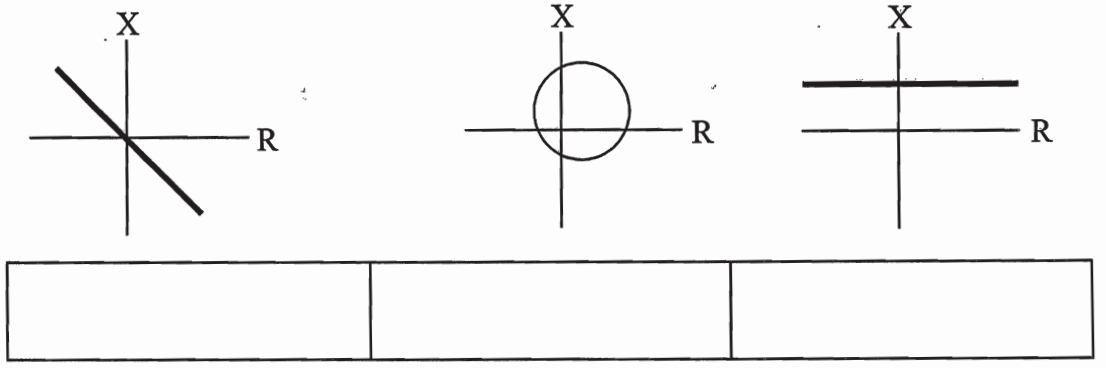
NAME :

ENTRY NO :

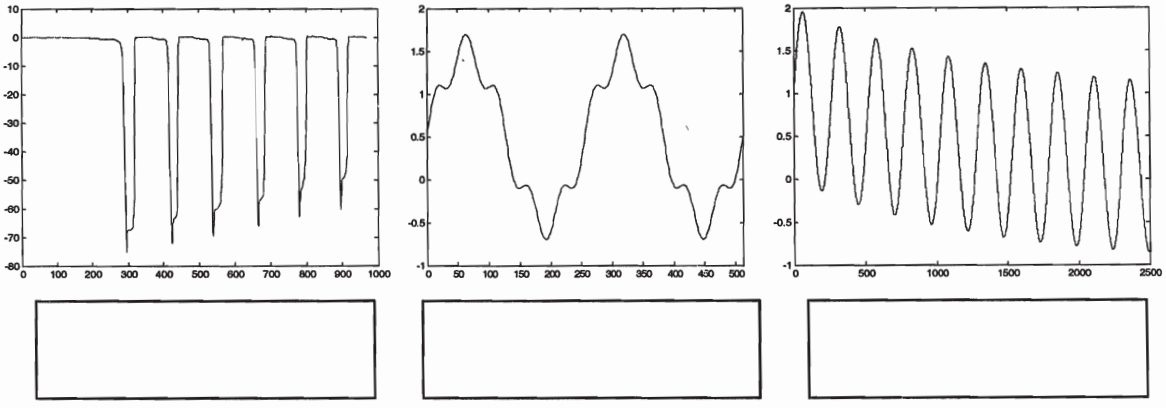
ANSWER IN THE QUESTION PAPER

6. Identify the relay Characteristics. [6]





7. Identify the following signals (How you can distinguish them?) [3]



8. What are the following RELAY Stands for [2]

87 G	
87 B	
87 T	
51	

9. Draw a neat sketch for differential protection of DELTA connected Alternator [2]

10. How a MHO relay is set ? [2]