B.E. (EE) Part-IV 8th Semester Examination, 2006

Power System Protection

(EE-801)

Time : 3 hours Full Marks : 100

Use separate answerscript for each half.
Answer SIX questions, taking THREE from each half.
Two marks are reserved for neatness in each half.

FIRST HALF

1. a) Deduce the equation of torque for Voltage-Current type induction Cup relay. State its special features.

   b) Explain, with the help of circuit diagram, the operation of Antihumping Scheme. State its location.

   c) Determine the time of operation of an I.D.M.T.L relay, of 3 See Version, of 1 Ampere rating having Plug setting 125% and T.M.S. = 0.4. The relay is connected !o[l]T?u[l]ppiytnf6ugfraC.'r. ot 100/1 A'm^tatloTliiven Tatllt CWfetir = 1250 Amp. [6+6+4]

2. a) "The maximum torque angle of a directional relay used for short circuit protection should not be equal to 0 or 180°" - Justify your answer.

   b) Establish the theory of duality between phase and Amplitude comparator. [8+8]

3. a) What are the points to be considered while designing a differential protection scheme of large delta-star connected power transformer.

   b) State the remedial actions for encountering above problems.

   c) Draw the C.T. connection diagram for Yd, and Dy_n connected power transformers.

   d) State the MVA rating of transformer above which the Buchholz relay and differential relays are used. [4+6+4+2]

4. a) A3 -phase S/cage induction motor is running at full load. A fuse in one phase is suddenly blown out. How will it affect the motor?

   b) Can a bi-metal overload prefect the motor from the above stated condition?

c) Give a complete scheme of a Motor Control Centre (M.C.C.) to protect a L.T. motor and explain the operation of the scheme. [4+4+8]

5. Write short notes on (any two) : |8x2]

a) Numerical relaying

b) Recovery inrush and sympathetic inrush current in power transformer.

c) Reactor protection Scheme.

d) Application of non-direction and directional over current relays for feeder protection.

SECOND HALF

6. Draw a neat circuit diagram of a rectifier bridge type of current comparator and explain its principle of operation under the following condition.

a) When operating current and restraining current are in phase.

b) When operating current and restraining current are out of phase. [2+7+7]

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7. a) Why is it necessary to provide protection against
   i) rotor earth fault of an alternator &
   ii) unbalanced three phase stator current in an alternator.

b) Draw a neat diagram of a protective scheme used for rotor earth fault of an alternator and explain its principle of operation. |(2+4)+lO]

8. a) Explain with a neat circuit diagram a scheme of protecting a three-phase underground cable using only two pilot wires.

b) What is power line carrier current protection? What are its merits and demerits? [10+6]

9. a) Derive a mathematical expression for a mho relay so that it is possible to draw its characteristics on R-X plain. What is the major difference between the characteristics of a mho relay and an ordinary impedance relay?

b) A line has resistance and reactance of 0.5 ohm and 2.0 ohm per kilometer respectively. The distributed capacitance of the line is negligible. The C.T. and P.T. used for the protection have ratios equal to 200 and 700 per phase. Represent 10 km length of the line on R-X plane in forward direction. Used squared paper.

c) Tow mho relays are used to protect 10 km length of the above line, The first one protects just 80% length and second one 100% length of that line plus possible arc resistance of 3.5 ohm per phase. Draw the characteristics of both the relays on the same squared paper. Assume that the centers of the mho relay characteristics lie on the line impedance vector. [7+4+5]

10. Briefly discuss the following : |6+5+5|

a) Function of line trap, coupling capacitor and radio frequency choke in carrier current type of pilot protection.

b) Over reach and under reach of a distance relay.

c) Reactance relay.