

B.E. (EE) Part-IV 8th Semester Examination, 2007

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 in each half for neatness.

FIRST HALF

1. a) Describe, with time-current characteristics, different types of over current relays.
b) State the cause and effect of over fluxing in case of operation of power transformer. How power transformers are protected against such conditions? [8+8]
2. a) Why is an earth fault in case of transformer dangerous? The star winding of a Delta-Star transformer, the star point of which is solidly grounded, is involved in single line to ground fault. Show the current distribution in the star winding and through the neutral.
b) Explain with neat diagram, the operation of Restricted Earth fault protection of a Delta-Star transformer.
c) Explain with a neat sketch, the operation of Buchholz relay. State its exact location with respect to the main tank. [(2+4)+5+5]
3. a) Name different types of motor faults. A H.T. motor faced mechanical jam during (i) Starting and (ii) running. What will happen to the motor and which protection will operate?
b) Give a scheme for complete protection of Star-Connected neutral ungrounded capacitor bank.
c) Explain Type-'C' coordination in case of L.T. motor protection. [(2+3+3)+4+4]
4. a) Establish duality between Phase and Amplitude Comparator.
b) State and explain the theory of Co-incidence Comparator. [9+7]
5. a) Draw the functional block diagram of digital protection scheme. Explain the function of (i) Analog input subsystem; (ii) Digital input sub-system; (iii) digital output sub-system.



- b) State the processes involved in digital protection.
- c) Draw, neatly, the connection diagram of directional over current relay for three phase short circuit protection. [(2+2+2+2)+4+4]

SECOND HALF

6. a) What are the drawbacks of simple differential scheme? Explain how the percentage differential relay overcomes the drawbacks of the simple differential relay.
- b) Derive the characteristic equation of the percentage differential relay.
- c) Prove that the slope of the internal fault characteristics for a single end fed system is 200%. [(4+4)+6+2]
7. a) What are the abnormal operating conditions to which a large turbo generator is likely to be subjected?
- b) Why the first ground fault on the motor of a generator does not cause any damage while a second fault can be catastrophic?
- c) Suggest a protective scheme for detecting rotor earth fault of a generator and explain its principle of operation. [4+2+10]
8. a) Derive the characteristics equation of a modified impedance relay and draw the characteristics on R-X plane.
- b) Draw impedance, reactance and mho characteristics to protect 100% of a line having an impedance of $(2.5 + j6)$ ohm. A fault may occur at any point on the line through an arc resistance of 2 ohm. Determine the maximum percentage of line section which can be protected by each type of relay. (Use a graph paper). [10+6]
9. Draw a schematic diagram showing the major components of a phasor comparison type of power line carrier current protection and explain its principle of operation. [16]
10. Write short notes on any two of the following : [2×8]
- a) Effect of loss of excitation of a turbogenerator
 - b) A.C. wire pilot relaying
 - c) Relay testing.

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