Class: TY Electrical **Subject: Switchgear and Protection**

Question bank

1. Explain need of power system protection. What are the different attributes of protection system? Explain in brief.
2. With neat diagram derive the expression for torque developed in the induction type relays.
3. Explain protection of
   a. Parallel feeders
   b. Ring main system
4. With neat diagram explain the zone od protection
5. Describe the primary and back up protection of the system.
6. Explain the desirable characteristics of protection system.
7. Draw and explain the following over current characteristics:
   a. Instantaneous
   b. Definite time
   c. IDMT
   d. Vey inverse
   e. Extremely inverse
8. Explain the operation of directional relay.
9. With neat diagram explain the applications of earth fault relay.
10. What are advantages and disadvantages of static relays?
11. The current rating of an overcurrent relay is 5A. The relay has a plug setting of 150% & time multiplier setting (TMS) of 0.4. The CT ratio is 400/5. Determine the operating time of the relay for a fault current of 6000A. At TMS=1, operating time at various PSM are as given below.

PSM	2	4	5	8	10	20
Operating time (in seconds)	10	5	4	3	2.8	2.4

12. Fault current = 2000A, Relay 1 set on 100%, CT ratio =200/1; Relay 2 set on 125%, CT ratio =200/1.

For discrimination the time grading margin between relays in 0.5 second Determine the time of operation of the two relays assuming that both the relays have the characteristics as shown in the following table & the Relay 1 has a TMS=0.2. Also determine the TMS of Relay 2. Time current characteristics of relay is given below.

PSM	2	3.6	5	8	10	15	20
Operating time (in seconds)	10	6	3.9	3.15	2.8	2.2	2.1

13. Explain following relays:
    a. Shaded pole type induction disc relay
    b. Induction cup type relay
14. Explain the phenomenon of arc in a circuit breaker. What is the need of arc?
15. Explain various methods of arc extinction in circuit breaker. Also explain the recovery rate theory and energy balance theory.
16. With neat waveform define and explain following terms:
    a. Arc voltage b. Re-striking voltage c. Recovery voltage
17. What is resistance switching? Derive an expression for critical resistance in terms of system inductance and capacitance so that no transient oscillations take place in a circuit breaker.
18. Derive an expression for re-striking voltage and RRRV of circuit breaker in terms of system inductance & capacitance.
19. Draw & describe the construction, working principle of air circuit breaker.
20. Draw & describe the construction, working principle of vacuum circuit breaker.
21. Draw & describe the construction, working principle of minimum oil circuit breaker and bulk oil circuit breaker.
22. Draw & describe the construction, working principle of air blast circuit breaker.
23. Draw & describe the construction, working principle of SF_6 circuit breaker.
24. Explain advantages, disadvantages and voltage rating of:
    a. Air circuit breaker
    b. Oil circuit breaker
    c. Air blast circuit breaker

d. SF6 circuit breaker
e. Vacuum circuit breaker

25. In a 132 kV system, the reactance per phase up to the location the circuit breaker is 5Ω and capacitance to earth is 0.03μF. Calculate:
    (a) The maximum value of the re-striking voltage across the contacts of the circuit breaker
    (b) Frequency of transient oscillation
    (c) Maximum value of RRRV
26. In a 132kV system, reactance and capacitance up to the location of the circuit breaker is 5Ω and 0.02μF, respectively. A resistance of 500Ω is connected across the breaker of the circuit breaker. Determine:
    a. Natural frequency of oscillation
    b. Damped frequency of oscillation
    c. Critical value of resistance
27. With neat block diagram explain the working principle of numerical relay.
28. What are the advantages and drawbacks of numerical relays?
29. With neat diagram explain simple differential protection.
30. What are the drawbacks of simple differential protection?
31. With neat diagram explain percentage differential protection.
32. Explain the following terms w.r.t. the differential protection; spill current, internal fault, through fault, through fault stability limit, through fault stability ratio.
33. With neat phasor diagram describe how 30^0 phase shift take place in delta- wye transformer.
34. Explain with neat diagram over current protection of transformer.
35. With neat phasor diagram describe the percentage differential protection of transformer.
36. Explain the protection of transformer using percentage differential relay with harmonic restraint.
37. Explain construction and working principle of Buchholz relay for transformer protection
38. What do you mean by over-fluxing or over excitation of transformer? What is the significance of V/f ratio? What is the principle of over-fluxing protection?
39. Write the generic torque equation of distance relay. Derive the torque condition for tripping in case of impedance relay and reactance relay.

40. Draw and explain the characteristics of impedance relay, reactance relay and Mho relay.
41. What is a role of excitation system and prime mover in alternator?
42. What are the various faults and abnormal conditions that will take place in generator?
43. With neat diagram explain longitudinal percentage differential protection of transformer?
44. Explain the protection of alternator against loss of excitation.
45. Explain the protection of alternator against the loss of prime mover.
46. Explain the protection of alternator against over-speeding.
47. Explain the protection of alternator against Unbalanced loading and Rotor field fault
48. Explain the lightening phenomenon.
49. Explain the protection against overvoltage using
    a) Earth wire
    b) Counterpoise wire
    c) Reduction of tower footing resistance.
50. Explain with neat diagram expulsion type lightening arrester, nonlinear lightening arrester and MOA type lightening arrester.