GUJARAT TECHNOLOGICAL UNIVERSITY

DI -5 SEMESTER – OLD PAPER – W23 TO S25 – QUESTION BANK(English)

Subject Name & Code:

Switchgear & Protection- 4350901

Unit I: Protective Relay System

Repeated Questions:

1. **Define/Explain: Characteristic Quantity, Resetting Ratio, PSM.**
    - **Appeared in:** S25 (Q1a, 03 marks)
2. **Explain Optical Current Transformer and state its application and advantages.**
    - **Appeared in:** S25 (Q1c, 07 marks), W24 (Q1c-OR, 07 marks), S24 (Q1c, 07 marks)
3. **Explain the basic elements of a protective system and state the desired functional characteristics.**
    - **Appeared in:** S24 (Q1c-OR, 07 marks)
4. **Define the following terms with respect to protective relays: (i) Overreach (ii) Operating Value (iii) Error.**
    - **Appeared in:** W23 (Q1a, 03 marks)
5. **List types of distance relays and explain the Impedance relay with a diagram.**
    - **Appeared in:** W23 (Q1c, 07 marks)

Other Important Questions:

6. **Apply Directional over current protection using a balance beam relay with a neat sketch.** (S25 - Q1b, 04 marks)
7. **Compare (with four points on either side) Instrument Transformer and Protective Transformer.** (S25 - Q1c1-OR, Part of 07 marks)
8. **Explain the basic tripping circuit in power system protection with a clear figure.** (S25 - Q1c2-OR, Part of 07 marks)
9. **Write the consequences of a fault and state the types of faults in overhead lines.** (W24 - Q1a, 03 marks)
10. **Explain carrier current protection of transmission lines with a block diagram.** (W24 - Q1b, 04 marks)
11. **Draw the schematic diagram of a numerical relay and briefly describe the functions of its various components.** (W24 - Q1c, 07 marks)
12. **State the classification of Protection of Line/Feeder.** (S24 - Q1a, 03 marks)

13. **Compare between Isolators and Circuit breaker.** (S24 - Q1b, 04 marks)
14. **Explain the abnormal conditions of the power system.** (W23 - Q1b, 04 marks)
15. **Explain with a diagram the carrier current protection scheme for transmission lines.** (W23 - Q1c-OR, 07 marks)

Unit II: Feeder, Transmission line and busbar protection

Repeated Questions:

1. **Explain construction, working and characteristics on R-X plane of Impedance relay with necessary diagrams.**
    - **Appeared in:** S25 (Q2c, 07 marks)
2. **Explain carrier current protection with neat diagram. Also explain the functions of the equipments connected in the systems.**
    - **Appeared in:** S25 (Q2c-OR, 07 marks), W24 (Q1b, 04 marks)
3. **Explain non-directional time graded over current protection system for protection of transmission line.**
    - **Appeared in:** S24 (Q2b, 04 marks), W23 (Q2b-OR, 04 marks)
4. **Explain circulating current protection for transmission line with diagram.**
    - **Appeared in:** W23 (Q2c, 07 marks)
5. **Explain construction and working of Mho type distance relay. Draw and explain its characteristic on R-X diagram.**
    - **Appeared in:** W24 (Q2c, 07 marks), S24 (Q2c-OR, 07 marks)

Other Important Questions:

6. **List out different types of distance relays and state which relay suits for protection of short, medium, long transmission line.** (S25 - Q2a, 03 marks)
7. **The current setting of over current relay is 200%. If the fault current is 4990 A, Find the fault current passing through relay, Pickup current, PSM of the relay if the ratio of C.T. is 1000/5.** (S25 - Q2b, 04 marks) *[Numerical]*
8. **List out different types of time characteristics of relays. Also state why IDMT characteristic is better.** (S25 - Q2a-OR, 03 marks)
9. **The current setting of over current relay is 100%. If the fault current is 9490 A, Find the fault current passing through relay, Pickup current, PSM of the relay if the ratio of C.T. is 1000/1.** (S25 - Q2b-OR, 04 marks) *[Numerical]*
10. **Draw and explain circulating current protection for busbar.** (W24 - Q2a, 03 marks)
11. **State and explain the limitations of overcurrent protection.** (W24 - Q2b, 04 marks)
12. **Draw and explain non directional current graded protection system for feeder.** (W24 - Q2a-OR, 03 marks)
13. **Explain protection of parallel feeders using directional over current relay.** (W24 - Q2b-OR, 04 marks)
14. **Explain the construction and working of reactance type distance relay. Draw and explain its characteristic on R-X diagram.** (W24 - Q2c-OR, 07 marks)
15. **State the necessity of backup protection and classify the backup protection.** (S24 - Q2a, 03 marks)

16. **Explain Negative phase sequence relay protection for detection of broken conductor in transmission line.** (S24 - Q2c, 07 marks)
17. **Compare Instrument transformer and Protective transformer.** (S24 - Q2a-OR, 03 marks)
18. **Explain the directional time graded protection system for feeder.** (S24 - Q2b-OR, 04 marks)
19. **Compare between current transformer and potential transformer.** (W23 - Q2a, 03 marks)
20. **Explain Non-direction current graded over current protection for protection of transmission line.** (W23 - Q2b, 04 marks)
21. **Compare between protective transformer and instrument transformer.** (W23 - Q2a-OR, 03 marks)
22. **Explain voltage balance type protection for transmission line with diagram.** (W23 - Q2c-OR, 07 marks)

Unit III: Transformer Protection

Repeated Questions:

1. **Explain Buchholz relay with a neat drawing.**
    - **Appeared in:** S25 (Q3b, 04 marks), S24 (Q3c, 07 marks), W23 (Q3c, 07 marks)
2. **Explain differential protection of power transformer.**
    - **Appeared in:** S25 (Q3b-OR, 04 marks)
3. **Explain Merz price protection for power transformers with diagram. / State difficulties in using Merz-Price protection of transformer and explain percentage biased differential relay protection for transformer.**
    - **Appeared in:** W23 (Q3c-OR, 07 marks), S24 (Q3c-OR, 07 marks)
4. **Explain negative phase sequence protection against unbalanced loading of Alternator.**
    - **Appeared in:** W23 (Q3b-OR, 04 marks)
5. **List out different abnormalities in Power Transformer. / List out different types of protection employed for power transformer.**
    - **Appeared in:** S25 (Q3a, 03 marks), S25 (Q3a-OR, 03 marks)

Other Important Questions:

6. **11 kV, 5 MVA, 15% reactance star connected alternator protected by merz-price protection system. At 250 A fault current relay operates. If 12% part of winding is unprotected then find out the value of earth resistance.** (S25 - Q3c, 07 marks) *[Numerical]*
7. **Show excitation failure protection and Field suppression protection of alternator with neat sketches.** (S25 - Q3c-OR, 07 marks)
8. **Draw Nitrogen Injection Fire Protection System (NIFPS) for power transformer and indicate each Part of it.** (S24 - Q3a, 03 marks)
9. **Explain parallel feeder protection with directional relay.** (S24 - Q3b, 04 marks)
10. **Explain Restricted Earth fault protection of power transformer with neat diagram.** (S24 - Q3a-OR, 03 marks)
11. **Explain circulating current protection for transmission line.** (S24 - Q3b-OR, 04 marks)
12. **Explain Winding Temperature Indicator (WTI) used for protection of transformer.** (W23 - Q3a, 03 marks)
13. **List out and Explain Abnormalities and faults occurring in Motor.** (W23 - Q3b, 04 marks)
14. **Explain Oil Temperature Indicator (OTI) used for protection of transformer.** (W23 - Q3a-OR, 03 marks)
15. **Explain the nitrogen injection fire protection system for power transformer.** (W24 - Q3c-OR, 07 marks)

16. **Explain the features of numerical differential relay and state its advantages.** (W24 - Q3c, 07 marks)
17. **Describe the percentage biased differential relay for transformer protection with neat diagram.** (W24 - Q3a-OR, 03 marks)
18. **Explain the protection against failure of alternator excitation with diagram.** (W24 - Q3b-OR, 04 marks)

Unit IV: Rotating machine protection

Repeated Questions:

1. **Explain Abnormalities and faults in Alternator. / List out & describe abnormalities occurring in alternator in detail.**
    - **Appeared in:** S25 (Q4c-OR, 07 marks), W23 (Q4c-OR, 07 marks), S24 (Q4b, 04 marks)
2. **Explain Abnormalities and faults in Induction Motor. / List out and Explain Abnormalities and faults occurring in Motor.**
    - **Appeared in:** S25 (Q4c, 07 marks), W23 (Q3b, 04 marks), S24 (Q4b-OR, 04 marks)
3. **Explain Reverse Power Protection of Alternator with neat diagram.**
    - **Appeared in:** S24 (Q4c, 07 marks)
4. **Explain negative phase sequence protection of alternator against unbalanced load.**
    - **Appeared in:** W24 (Q3b, 04 marks)
5. **Draw and explain restricted earth fault protection for alternator.**
    - **Appeared in:** W23 (Q4c, 07 marks)

Other Important Questions:

6. **List types of Abnormalities and Faults occurring in Alternator.** (S24 - Q4b, 04 marks)
7. **Explain Inter-turn fault in Alternator having Multi-turn stator winding with neat diagram.** (S24 - Q4c-OR, 07 marks)
8. **List types of Abnormalities and Faults occurring in Induction Motor.** (S24 - Q4b-OR, 04 marks)
9. **Explain the protection against failure of alternator excitation with diagram.** (W24 - Q3b-OR, 04 marks)
10. **Explain the features of numerical differential relay and state its advantages.** (W24 - Q3c, 07 marks)
11. **Explain negative phase sequence protection against unbalanced loading of Alternator.** (W23 - Q3b-OR, 04 marks)
12. **Explain Merz price protection for power transformers with diagram.** (W23 - Q3c-OR, 07 marks) *[Also relevant to Transformer Protection]*
13. **List out and Explain Abnormalities and faults occurring in Motor.** (W23 - Q3b, 04 marks)

Unit V: Circuit breaker

Repeated Questions:

1. **Explain working of Vacuum circuit breaker with diagram. / Draw and explain the construction and working of vacuum circuit breaker and state its advantages and applications.**
    - **Appeared in:** S25 (Q5c-OR, 07 marks), W23 (Q5c, 07 marks), W24 (Q5c, 07 marks)
2. **Explain working of SF6 circuit breaker with Diagram. / Draw and explain the construction and working of SF6 circuit breaker and state its advantages and applications.**
    - **Appeared in:** S25 (Q5c, 07 marks), W23 (Q5c-OR, 07 marks), W24 (Q5c-OR, 07 marks)
3. **Compare Isolator and Circuit breaker.**
    - **Appeared in:** S24 (Q1b, 04 marks), W23 (Q5b, 04 marks)
4. **Define: (1) Arcing Time (2) Restriking Voltage (3) RRRV (4) Total Breaking Time / Explain the following terms with reference to circuit breaker: 1) Restriking voltage 2) RRRV 3) Recovery voltage 4) Active Recovery voltage.**
    - **Appeared in:** S25 (Q4b, 04 marks), W24 (Q5b, 04 marks)
5. **Explain Insulation coordination.**
    - **Appeared in:** S25 (Q5a, 03 marks), S24 (Q5a, 03 marks), W23 (Q4a-OR, 03 marks)

Other Important Questions:

6. **Find out breaking capacity, rated symmetrical breaking current and rated making current of a 3-phase circuit breaker of 400 A, 1000 MVA, 132 kV, 3 seconds.** (S25 - Q4a, 03 marks) *[Numerical]*
7. **Find out breaking capacity, rated symmetrical breaking current and rated making current of a 3-phase circuit breaker of 100 A, 500 MVA, 66 kV, 3 seconds.** (S25 - Q4a-OR, 03 marks) *[Numerical]*
8. **Write different types of isolators and also state the interlocking between isolator and circuit breaker and its correct operating sequence.** (S25 - Q4b-OR, 04 marks)
9. **Classify types of circuit breaker based on Actuating medium, interrupting medium, installation and external design.** (S24 - Q5b, 04 marks)
10. **Define Making and Breaking Capacity of Circuit Breaker and explain SF6 Circuit breaker with neat diagram.** (S24 - Q5c, 07 marks)
11. **Define Recovery voltage and RRRV of Circuit Breaker and Explain Vacuum Circuit Breaker with neat diagram.** (S24 - Q5c-OR, 07 marks)
12. **Explain overvoltage due to Internal Causes.** (S24 - Q5a-OR, 03 marks)
13. **Describe operation sequence of interlocking between Isolators, Circuit breaker and Earthing Switch.** (S24 - Q5b-OR, 04 marks)
14. **Explain resistance switching in Circuit breaker.** (W23 - Q4b, 04 marks)

15. **Explain low resistance interruption of arc current in circuit breaker.** (W23 - Q4b-OR, 04 marks)
16. **Explain working of horn gap arrester with diagram.** (W23 - Q5a, 03 marks)
17. **Compare Fuse and Circuit breaker.** (W23 - Q5b-OR, 04 marks)
18. **Explain working of sphere gap arrester with diagram.** (W23 - Q5a-OR, 03 marks)
19. **Write a short note on surge absorber.** (W24 - Q5a, 03 marks)
20. **Explain the circuit breakers used for HVDC systems.** (W24 - Q5b-OR, 04 marks)
21. **Write a short note on insulation co-ordination.** (W24 - Q5a-OR, 03 marks)
22. **Explain high resistance interruption of arc in circuit breaker.** (W24 - Q4b-OR, 04 marks)
23. **Describe construction and working of cross blast air circuit breaker with diagram.** (W24 - Q4b, 04 marks)
24. **Explain HVDC circuit breaker with necessary diagrams. Also explain current zero situation, prevention of restriking and dissipation of stored energy.** (S25 - Q5c-OR, 07 marks)
25. **Classify different types of Lightning Arrester and with a neat sketch explain working of horn gap arrester.** (S25 - Q5b, 04 marks)
26. **Explain the operating principle of lightning arrestor.** (S25 - Q5a-OR, 03 marks)
27. **Classify various causes of Over Voltages and explain overvoltage due to Internal Causes.** (S25 - Q5b-OR, 04 marks)
28. **Explain Thyrite type lightning arrester. / Describe the construction and working of thyrite type arrester with neat diagram.** (S24 - Q4a, 03 marks), (W24 - Q4a, 03 marks)
29. **Explain construction and working of surge absorber with neat diagram.** (S24 - Q4a-OR, 03 marks)
30. **Explain the operating principle of lightning arrestor.** (W23 - Q4a, 03 marks)

Unit VI: Lightening Protection

Repeated Questions:

1. **Explain Thyrite type lightning arrester. / Describe the construction and working of thyrite type arrester with neat diagram.**
    - **Appeared in:** S24 (Q4a, 03 marks), W24 (Q4a, 03 marks)
2. **Explain working of horn gap arrester with diagram. / Classify different types of Lightning Arrester and with a neat sketch explain working of horn gap arrester.**
    - **Appeared in:** W23 (Q5a, 03 marks), S25 (Q5b, 04 marks)
3. **Explain the operating principle of lightning arrestor.**
    - **Appeared in:** W23 (Q4a, 03 marks), S25 (Q5a-OR, 03 marks)
4. **Explain Insulation coordination in detail. / Explain Insulation coordination.**
    - **Appeared in:** S25 (Q5a, 03 marks), S24 (Q5a, 03 marks), W23 (Q4a-OR, 03 marks)
5. **Write a short note on surge absorber. / Explain construction and working of surge absorber with neat diagram.**
    - **Appeared in:** W24 (Q5a, 03 marks), S24 (Q4a-OR, 03 marks)

Other Important Questions:

6. **Classify various causes of Over Voltages and explain overvoltage due to Internal Causes.** (S25 - Q5b-OR, 04 marks)
7. **Explain overvoltage due to Internal Causes.** (S24 - Q5a-OR, 03 marks)
8. **Explain working of sphere gap arrester with diagram.** (W23 - Q5a-OR, 03 marks)

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