

Chapter wise Question bank
SUB-SWITCH EAR AND PROTECTIVE DEVICES

1. INTRODUCTION TO SWITCHGEAR

SHORT TYPE

1. What do you understand by switchgear?
2. What are the limitations of a fuse?
3. Why do we use C.T. in the relay circuit?
4. What is the necessity of busbar?
5. Why do we use isolators on both sides of the circuit breaker?
6. Why are isolators not opened on load?
7. Which faults ___ symmetrical or unsymmetrical ___ are more frequent in power system and why?
8. Suddenly a circuit carries a current 20 times the normal current. Is there possibility of short-circuiting or Overload?

LONG TYPE

1. Discuss the various types of switches.
2. What is the difference between?
 - (i) a switch and circuit breaker
 - (ii) a fuse and circuit breaker?
3. Discuss the different types of bus-bar arrangements.
4. Explain the various methods of accommodating high-voltage switchgear.

2. Symmetrical Fault Calculations

SHORT TYPE

1. Why do we choose a base kVA in short-circuit calculations?
2. What is the advantage of expressing reactance in percentage values?
3. Why do we decide the rating of a circuit breaker on the basis of symmetrical short-circuit currents?
4. Will the value of short-circuit current change if we take different base kVAs'? Explain your answer.
5. Can feeder reactors permit the use of circuit breakers of lower ratings?

LONG TYPE

1. What do you understand by a short-circuit? Discuss the possible causes of short-circuit in the power system.
2. Explain the harmful effects of short-circuit fault on the power system.
3. What is the importance of short-circuit calculations?
4. Discuss the possible faults on overhead lines.
5. What do you understand by percentage reactance? Why do we prefer to express the reactances of various elements in percentage values for short-circuit calculations?
6. What is the importance of base kVA in short-circuit calculations?
7. Why do we use reactors in the power system? Discuss their advantages.
8. Explain the various methods of connecting short-circuit current limiting reactors in the power system.

PROBLEMS

1. A 3-phase, 30 MVA, 33 kV alternator has internal reactance of 4% and negligible resistance. Find the external reactance per phase to be connected in series with the alternator so that steady current on shortcircuit does not exceed 10 times the full load current.
2. A 3-phase transmission line operating at 33 kV and having a resistance of $5\ \Omega$ and reactance of $20\ \Omega$ is connected to the generating station through 15,000 kVA step-up transformers. Connected to the bus-bar are two alternators, one of 10,000 kVA with 10% reactance and another of 5000 kVA with 7.5% reactance. Calculate the short-circuit kVA fed to the symmetrical fault between phases if it occurs
 - (i) at the load end of transmission line

(ii) at the high voltage terminals of the transformer

3. The plant capacity of a 3-phase generating station consists of two 8 MVA generators of reactance 14.5% each and one 4 MVA generator of reactance 9.5%. These are connected to a common bus-bar from which loads are taken through a number of 3 MVA step-up transformers each having 4% reactance. Determine the MVA rating of the circuit breakers on

(i) L.V. side and

(ii) H.V. side. Reactances given are based on the MVA of each equipment.

3. FUSES

SHORT TYPE

1. What is a fuse ? Discuss the advantages and disadvantages of a fuse.

2. Why do we prefer silver as a fuse element?

3. Define and explain the following terms

(i) Fusing current (ii) cut off current (iii) operating time (iv) breaking capacity

4. Why are circuit breakers preferred to fuse?

5. Why fuses cannot provide adequate discrimination on heavy short-circuit?

6. Why fuses can interrupt heavy short-circuit currents successfully?

LONG TYPE

1. Write short notes on the following:

(i) Semi-enclosed rewirable fuse

(ii) H.R.C. cartridge fuse

(iii) Difference between a fuse and circuit breaker

2. What is a fuse? Discuss the advantages and disadvantages of a fuse.

4. CIRCUIT BREAKERS

SHORT TYPE

1. Why do plain break oil circuit breakers have a low speed of circuit interruption?

2. Is it logical to express the breaking capacity of a circuit breaker in MVA? Discuss.

3. Why is current interruption easier in an a.c. circuit than in a d.c. circuit?

4. Why are circuit breakers designed to have a short-time rating?

5. Is arc production in a circuit breaker unfortunate manifestation?

6. Which are the contact materials in the vacuum circuit breakers?

7. **Give three examples of over current Protection Devices.**

8. Does the circuit breaker help in switching during short circuit conditions?

9. What is a circuit breaker?

10. What are the advantages of circuit breakers?

11. What are the disadvantages of the circuit breaker?

12. What are the types of circuit breakers?

13. Define oil circuit breakers.

LONG TYPE

1. What is a circuit breaker? Describe its operating principle.

2. Discuss the arc phenomenon in a circuit breaker.

3. Explain the various methods of arc extinction in a circuit breaker.

4. Define and explain the following terms as applied to circuit breakers:

(i) Arc voltage

(ii) Restriking voltage

(iii) Recovery voltage

5. Describe briefly the action of an oil circuit breaker. How does oil help in arc extinction?
6. Discuss the advantages and disadvantages of oil circuit breakers.
7. Explain with neat sketches the construction and working of the following circuit breakers:
 - (i) Plain explosion pot
 - (ii) Cross jet explosion pot
 - (iii) Self-compensated explosion pot
8. Explain the difference between bulk oil circuit breakers and low-oil circuit breakers.
9. Discuss the constructional details and operation of a typical low-oil circuit breaker? What are its relative merits and demerits?
10. Discuss the principle of operation of an air-blast circuit breaker. What are the advantages and disadvantages of using air as the arc quenching medium?
11. Explain briefly the following types of air-blast circuit breakers:
 - (i) Axial-blast type
 - (ii) Cross-blast type
12. What are the important components common to most of circuit breakers? Discuss each component briefly.
13. Write a short note on the rate of re-striking voltage indicating its importance in the arc extinction.
14. Discuss the phenomenon of
 - (i) Current chopping
 - (ii) Capacitive current breaking
15. Write short notes on the following:
 - (i) Resistance switching
 - (ii) Circuit breaker ratings
 - (iii) Circuit interruption problems

5. PROTECTIVE RELAYS

SHORT TYPE

1. What is the difference between a fuse and a relay?
2. What is the difference between an overcurrent relay and current differential relay?
3. Back-up protection is not a good substitute for better maintenance. Discuss.
4. Why are differential relays more sensitive than overcurrent relays?
5. What is the difference between a balanced voltage relay and a Translay Relay?

LONG TYPE

1. What is protective relay? Explain its function in an electrical system.
2. Discuss the fundamental requirements of protective relaying.
3. Describe briefly some important types of electromagnetic attraction relays.
4. Derive the equation for torque developed in an induction relay.
5. Write a brief note on relay timing.
6. Define and explain the following terms as applied to protective relaying:
 - (i) Pick-up value
 - (ii) Current setting
 - (iii) Plug-setting multiplier
 - (iv) Time-setting multiplier
7. Sketch a typical time/P.S.M. curve.
8. Describe the various steps for calculating the actual relay operating time.
9. Explain with the help of neat diagram the construction and working of :
 - (i) Non-directional induction type overcurrent relay
 - (ii) Induction type directional power relay
10. Describe the construction and principle of operation of an induction type directional overcurrent relay.
11. Explain the working principle of distance relays.
12. Write a detailed note on differential relays.

13. Describe the Translay scheme of protection.
14. Write short notes on the following:
 - (i) Percentage differential relays
 - (ii) Definite distance relays
 - (iii) Time-distance relays

6. PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES

SHORT TYPE

1. What methods can be used to prevent saturation of current transformers?
2. What factors govern choosing pilot-wire installation?
3. Why must directional relays be used on a ring main system?
4. How does time-delay overcurrent relays work on a radial system?
5. Do overhead systems need differential protection schemes than underground systems?
6. How are pilot-wire relays built for transmission-line protection?
7. What is the importance of bus-bar protection?
8. What are the requirements of protection of lines?
9. What is the difference between an earth relay and overcurrent relay?
10. How does grounding affect relay application?
11. Why is overload protection not necessary for alternators?
12. How many faults develop in a power transformer?

LONG TYPE

1. Describe the following systems of bus-bar protection:
 - (i) Differential protection
 - (ii) Fault-bus protection
2. Discuss the time-graded overcurrent protection for
 - (i) Radial feeders
 - (ii) Parallel feeders
 - (iii) Ring main system
3. Describe the differential pilot wire method of protection of feeders.
4. Describe distance protection scheme for the protection of feeders.
5. Write short notes on the following:
 - (i) Fault-bus protection
 - (ii) Merz-Price voltage balance system for protection of feeders
 - (iii) Translay scheme
6. Discuss the important faults on an alternator.
7. Explain with a neat diagram the application of Merz-Price circulating current principle for the protection of alternator.
9. Describe the construction and working of a Buchholz relay.
10. Describe the Merz-Price circulating current system for the protection of transformers.
11. Write short notes on the following:
 - (i) Earth-fault protection for alternator
 - (ii) Earth-fault protection for transformers

7. PROTECTION AGAINST OVER VOLTAGE AND LIGHTING

SHORT TYPE

1. Why are steep fronted surges more dangerous to power system equipment?
2. Why is lightning accompanied by a thunder?
3. Is the name lightning arrester appropriate?
4. Why are surge diverters located very close to the equipment to be protected?
5. Where will you use a surge absorber?

LONG TYPE

1. What is a voltage surge? Draw a typical lightning voltage surge.
2. Discuss the causes of over voltages.
3. What is lightning? Describe the mechanism of lightning discharge.
4. Describe the various types of lightning stroke.
5. What are the harmful effects of lightning?
6. How do earthing screen and ground wires provide protection against direct lightning strokes?
7. What is a surge diverter? What is the basic principle of operation of a surge diverter?
8. Write short notes on the following surge diverters:
 - (i) Rod gap diverter
 - (ii) Horn gap diverter
 - (iii) Expulsion type diverter
 - (iv) Multigap diverter
9. Discuss the construction, principle and working of a valve type arrester.
10. What is a surge absorber? Write a short note on Ferranti surge absorber.

8. STATIC RELAY:**SHORT TYPE**

1. What is Static Relay?
2. What are the types of Static Relay?
3. Advantages of static Relay.

LONG TYPE

1. Explain IDMT Relay?
 2. Explain Instantaneous over current relay.
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