

SWITCHGEAR AND PROTECTION*Time Allowed: 2.5 Hours**Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.
Answer any Five (05) Questions from Group-B.

GROUP-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): 2x10=20
 - i. What is the purpose of current limiting reactors in an electrical system? a) To limit the voltage across the system, b) To limit the fault current and protect the system, c) To improve power factor, d) None of the above.
 - ii. Most of the faults on overhead systems are _____ faults. (a) L-L (b) L-G (c) L-L-L (d) L-L-L-G
 - iii. Fusing Factor is always - a) more than 1, b) less than 1, c) equal to 1, d) None of these.
 - iv. Circuit Breaker generally operates under _____ part of fault current.
a) Sub-transient b) Transient c) Steady state d) None of the above
 - v. An isolator is installed usually in
a) one side of circuit breaker b) parallel with circuit breaker c) both side of circuit breaker
d) none of the above
 - vi. The transient voltage that appears across the circuit breaker contacts at the instant of arc extinction is known as - a) flash-over voltage, b) breaking voltage, c) recovery voltage, d) re-striking voltage.
 - vii. SF6 circuit breaker is superior than oil circuit breaker due to the fact that (a) low thermal stability. (b) good insulating property. (c) good arc quenching property. (d) both b and c.
 - viii. Induction relays are used with..... quantities. (a) ac (b) dc (c) ac and dc (d) None of these.
 - ix. Earth fault protection relay has _____ current setting than over current relay. (a) more (b) less (c) same (d) none of these.
 - x. Which type of relay is most suitable for protecting long transmission lines?
a) Mho relay b) Reactance relay c) Impedance relay d) Negative sequence relay
 - xi. A 300/5 CT is connected with an induction type over current relay. The current setting of the relay coil is 125%. The pick up current of the relay is - a) 6.25A b) 5A c) 1.25A d) 4.
 - xii. Due to failure of prime mover alternators connected to grid run as
a) induction motor b) synchronous motor c) dc motor d) none of the above
 - xiii. For the protection of a Delta-Star transformer using differential protection, the CT connection in primary and secondary side of transformer should be _____ respectively.
a) Star & Delta b) Star & Star c) Delta & Star d) Delta & Delta

- xiv. Which of the following is the protective device against over voltages in transmission lines? a) Rod gap
b) Horn Gap c) Surge absorber d) All of these.
- xv. A thyrite type lightning arrester - a) blocks the surge voltage appearing in a line. b) absorbs the surge voltage appearing in a line. c) offers a low resistance path to surge appearing in a line. d) returns the surge back to source.

GROUP-B

Answer any Five (05) Questions.

2. a) Write the names of different types of faults occur in power systems.
b) A 3-phase transmission line operating at 10 KV and having a resistance of 1Ω and reactance 4Ω is connected to the generating station bus-bars through 5MVA step-up transformer having a reactance of 5%. The bus-bars are supplied by 10MVA alternator having 10% reactance. Calculate the short-circuit KVA fed to symmetrical fault between phases if it occurs: i) at the load end of transmission line, ii) at the high voltage terminals of the transformer.
2+6
3. a) Define symmetrical breaking capacity, making capacity of a circuit breaker.
b) Write short note on "Principles of arc extinction in Circuit Breaker". (2+2) +4
4. a) Explain the working of Earth leakage Circuit Breaker (ELCB) with diagram and write its functions.
b) State the differences between MCB and fuse. 5 + 3
5. a) What are the desirable characteristics of a fuse element?
b) Explain Auto-reclosing of circuit breaker.
c) What are the properties of SF₆ that makes it suitable for use in Circuit breaker? 2 + 3 +3
6. a) Draw block diagram of a static overcurrent relay.
b) An overcurrent relay of rating 5 Amp has a current setting 150% and time multiplier setting (TMS) of 0.5. The relay is connected in the circuit through CT having ratio 500/5. Calculate the time of operation of relay if the circuit carries a fault current 6000 amps. The relay has the following characteristics.
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|-------------|---|-----|---|---|-----|-----|-----|----|
| PSM | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Time in sec | 7 | 5.5 | 5 | 4 | 3.8 | 3.5 | 3.1 | 3 |
- 3 + 5
7. a) Define primary protection & back-up protection. <https://www.wbscteonline.com>
b) Explain the operating principle of Impedance relay with torque equation.
c) Write working principle and application of CVT and CCVT. 2+3+3
8. a) Describe the construction and principle of operation of a Buchholz relay with a neat diagram.
b) Explain the percentage differential protection of alternator with diagram. 4+4
9. a) Discuss important faults in alternator, for which protection is needed.
b) Briefly discuss time graded and current graded protection of transmission lines. 4 +4
10. a) What is meant by Insulation Coordination?
b) Write short notes on any two- i) Valve Type Lightning Arrester, ii) Horn Gap Type Lightning Arrester, iii) Rod Gap Type Lightning Arrester iv) Metal Oxide Arrester. 2+(2×3)