

Switchgear and Protection (315334)

MSBTE Diploma · K-Scheme · Model Question Paper — Set A

Time: 3 Hours**Max. Marks: 70****Instructions:**

1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Use of non-programmable electronic pocket calculator is permissible.
7. Mobile phone, pager and any other electronic communication devices are not permissible in the examination hall.

Q.1 Attempt any FIVE of the following:**10**

- a) List any four types of faults that occur in a three-phase power system.
- b) Define fusing factor. Why is it always greater than one?
- c) State any four essential qualities of a protective relay.
- d) Define: i) Plug setting multiplier (PSM) ii) Time setting multiplier (TSM).
- e) State the location and the purpose of Buchholz relay.
- f) Name the types of isolators based on their construction.
- g) List any four abnormal conditions (faults) that occur in a three-phase induction motor.

Q.2 Attempt any THREE of the following:**12**

- a) Explain the need of protective zones. Draw a single line diagram showing overlapping protective zones of a power system.
- b) Draw the generator reactor and feeder reactor arrangements. State one advantage and one disadvantage of each.
- c) Explain the high resistance method of arc extinction with a neat sketch.
- d) Describe the construction and working of induction disc type IDMT over-current relay with a neat sketch.

Q.3 Attempt any THREE of the following:**12**

- a) A 15 MVA, 11 kV, 3-phase alternator has a reactance of 12 %. It is connected through a 10 MVA, 11/66 kV transformer of 8 % reactance to a transmission line having resistance and reactance per conductor per km of 0.25Ω and 0.6Ω respectively. A symmetrical 3-phase fault occurs at a distance of 30 km along the line. Calculate the fault current and the fault MVA.
- b) State any four points of difference between fuse and circuit breaker.
- c) With a neat block diagram explain the working of a static relay.

- d) Draw and explain the connection of over-current and earth-fault relays using residual connection of CTs.

Q.4 Attempt any THREE of the following:

12

- a) A 5 A IDMT over-current relay has a current setting of 125 % and a time multiplier setting of 0.5. It is connected through a CT of ratio 400/5. Calculate the operating time of the relay for a fault current of 6000 A.

Time/PSM curve of the relay (TMS = 1):

PSM	2	3	4	5	6	8	10	12	15	20
Time (s)	10.03	6.30	4.98	4.28	3.84	3.30	2.97	2.75	2.52	2.27

- b) Explain the single phasing preventer used for protection of a 3-phase induction motor with a neat block diagram.
- c) Explain the working of a residual current circuit breaker (RCCB / ELCB) with a neat diagram.
- d) Explain Merz-Price voltage balance (pilot wire) protection of a transmission line with a neat diagram.
- e) Explain fault bus (frame leakage) protection of bus-bars with a neat diagram.

Q.5 Attempt any TWO of the following:

12

- a) Explain the construction and working of puffer type SF₆ circuit breaker with a neat sketch. State any four properties of SF₆ gas that make it suitable for arc quenching.
- b) Draw the block diagram of a microprocessor based over-current relay and explain the function of each block. State any four advantages.
- c) Explain Merz-Price circulating current protection of an alternator with a neat diagram. Why is a percentage (biased) differential relay preferred?

Q.6 Attempt any TWO of the following:

12

- a) A 3-phase, 11 kV / 132 kV, delta-star transformer is protected by Merz-Price circulating current system. The CTs on the low voltage side have a ratio of 500/5. Determine the ratio of the CTs on the high voltage side. Draw a neat diagram showing the CT connections.
- b) Explain time-graded protection of a radial feeder with a neat diagram. State its drawbacks.
- c) i) List any four faults that occur in an alternator. ii) Explain reverse power protection of an alternator with a neat diagram.

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in