

Switchgear and Protection (315334)

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

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) State any four effects of short-circuit faults on a power system.
- b) Define: i) Base kVA ii) Percentage reactance.
- c) State any two differences between air insulated switchgear (AIS) and gas insulated switchgear (GIS).
- d) Explain the terms speed and sensitivity of a protective relay.
- e) Define: i) Relay time ii) Current setting of a relay.
- f) State any two applications of MHO relay.
- g) State any two differences between Type-1 and Type-2 coordination of motor starters.

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

- a) Two 3-phase, 11 kV generators of 20 MVA (10 %) and 30 MVA (15 %) feed a common bus-bar. Calculate: i) short-circuit MVA for a bus-bar fault, ii) reactance (Ω per phase) of a feeder reactor to limit the feeder fault level to 250 MVA.
- b) Explain the low resistance (current-zero) method of arc extinction. Explain the recovery rate theory of arc interruption.
- c) With a neat diagram explain the components of a protective system and state their functions.
- d) Explain the inverse time–current characteristic of a fuse. Define: prospective current, cut-off current and arcing time.

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

- a) State any four differences between isolator and circuit breaker. Why should an isolator never be opened on load?
- b) Explain the construction and working of an air break circuit breaker (ACB) with a neat sketch.

- c) Radial feeder: relay R2 (load end) — CT 200/5, plug setting 125 %, TMS 0.2; relay R1 (source end) — CT 400/5, plug setting 100 %. For a fault current of 2000 A beyond R2, find the operating time of R2 and the TMS of R1 for a discrimination time of 0.5 s.

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

- d) Draw the block diagram of a static over-current relay. State any four advantages of static relays over electromagnetic relays.

Q.4 Attempt any THREE of the following:

12

- Explain stator earth-fault protection of an alternator with a neat diagram.
- Draw a neat labelled sketch of Buchholz relay. State its advantages and limitations.
- State the importance of single phasing preventer for a 3-phase induction motor. Explain its working with a neat sketch.
- Define differential relay. Explain the operation of current (circulating current) differential relay with a neat diagram.
- State the causes of bus-bar faults. Explain frame leakage (fault bus) protection of bus-bars.

Q.5 Attempt any TWO of the following:

12

- i) Draw a neat sketch of vacuum interrupter and explain the working of VCB. ii) Compare VCB and SF₆ circuit breaker (any four points).
- Draw the block diagram of a digital (microprocessor based) relay and explain each block. What is a numerical relay?
- i) Explain restricted earth-fault protection of a transformer with a neat diagram. ii) Explain overheating protection of a transformer.

Q.6 Attempt any TWO of the following:

12

- Explain three-zone distance protection of a transmission line with a time–distance characteristic. Draw the R–X characteristics of impedance, reactance and MHO relays.
- State the applications of pilot-wire protection. Explain the voltage balance pilot-wire system and compare it with the circulating current system (any four points).
- i) List any four faults in an induction motor. ii) Suggest and explain protection schemes for small LT motors and large HT motors.

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