

Dec.-23-0503

EE-601 (Switchgear and Protection)

B.Tech. 6th (CBCS)

Time : 3 Hours

Max. Marks : 60

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt FIVE questions in all, selecting one question each from section A, B, C and D. Section E is compulsory.

#### SECTION - A

1. (a) Why is a power system divided into a number of protective zones? Why do adjacent zones overlap? (5)
- (b) What are the advantages of static relays over electromechanical relays? (5)
2. (a) With a neat sketch, explain the construction and working principle of a reverse power or directional relay. (5)
- (b) Discuss construction and operating principle of induction type of electromagnetic relay. Derive its torque equation. (5)

#### SECTION - B

3. (a) Explain stepped time-distance characteristic of three distance relaying units used for I, II, III zone protection of transmission line. (5)
- (b) With a neat sketch explain the working of frame leakage protection used for buszone protection. (5)
4. (a) What are the disadvantages of simple differential protection of a transformer because of which biased differential protection is used? (5)

- (b) A 3-phase transformer of 220/11000V line volts is connection in star/delta. The protective transformers on 220 V side have a current ratio of 600/5. What should be the CT ratio on 10,000 V side? (5)

#### SECTION - C

5. (a) A Star connected 3- $\phi$ , 25MVA, 11kV generator has a per phase reactance of 12%. It is protected by merz-price circulating current principle which is set to operate for fault current not less than 170 A. Find the value of earth resistance to be provided in order to ensure that only 12% of the generator winding remains unprotected. (5)
- (b) Explain how the rotor of an alternator will be protected by field ground fault protection. (5)
6. (a) Discuss the limitations of static relays over electromagnetic relays. Also explain the working of solid-state relay with the help of suitable block diagram. (5)
- (b) With a neat sketch, explain the operating principle of a rectifier bridge amplitude type comparator. (5)

#### SECTION - D

7. (a) What is meant by circuit breaker? Discuss the phenomenon of arc formation in a circuit breaker. (5)
- (b) With a neat sketch, explain the working of oil circuit breaker. (5)
8. (a) With a neat sketch, explain the indirect testing of circuit breaker. (5)
- (b) What is the need of fuse? With a neat sketch, explain the operation of the HRC Cartridge fuse. (5)

**SECTION - E (Compulsory)**

9. Attempts all questions.

- (a) Define the term PSM in relays.
- (b) What are unit system and non unit system?
- (c) Define operating time of a relay.
- (d) Mention the short comings of Merz Price scheme of protection applied to a power transformer.
- (e) Define overreach and underreach.
- (f) What are the main types of stator winding faults?
- (g) What are the main safety devices available with transformer?
- (h) What is over fluxing protection in transformer?
- (i) What is restriking voltage?
- (j) What are the advantages of air blast circuit breaker over oil circuit breaker? (10×2=20)