

16117

3 Hours / 100 Marks

Seat No.

--	--	--	--	--	--	--	--

- 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 Examination Hall.

Marks

1. (A) Attempt any **THREE** of the following : **12**
- (a) What are the causes of faults in power system ? State any four harmful effects of faults.
 - (b) Explain the terms base kVA, base kV and percentage reactance. State the relationship between them.
 - (c) Define the terms 'Plug Setting Multiplier' and 'Time Setting Multiplier' as used in the context of IDMT relay.
 - (d) What is a voltage surge ? Draw a typical standard lighting voltage surge.
- (B) Attempt any **ONE** of the following : **6**
- (a) Two 3-phase, 6.6 kV, 5 MVA generators having sub-transient reactances of 12.5% operate in parallel. The generators supply power to a transmission line through a 10 MVA transformer of ratio 6.6/33 kV and having a leakage reactance of 4%. Calculate fault current and fault MVA for 3-phase fault on (i) LT side and (ii) HT side of transformer.

- (b) A 3-phase 66/11 kV star-delta connected transformer is protected by Merz-Price protection scheme. The CTs on the LT side have a ratio of 420/5 A. Find the ratios of the CTs on the HT side. Also draw a neat connection diagram of the complete scheme.

2. Attempt any FOUR of the following :

16

- (a) Explain the terms :
- (i) Arc voltage
 - (ii) Recovery voltage
 - (iii) Restriking voltage
 - (iv) RRRV
- (b) With a neat sketch explain the construction and working of HRC fuse.
- (c) What are surge absorbers ? How they differ from surge diverters ?
- (d) State any four advantages of grounding the neutral of a system.
- (e) Describe the difference between definite characteristics and inverse characteristics of relays.
- (f) With a neat sketch explain Merz-Price protection as applied to alternator.

3. Attempt any FOUR of the following :

16

- (a) State different types of circuit breakers (at least four) based on the medium used for arc quenching. Also mention the voltage range for which each circuit breaker is recommended.
- (b) Differentiate between isolator and circuit breaker (any four points).
- (c) With a neat block diagram explain the operation of static overcurrent relay.
- (d) List the special problems in applying biased differential protection to 3-phase transformer. How are they over come ?
- (e) What is Buchholz relay ? Which equipment is protected by it ? State its any two advantages and limitations.

4. (A) Attempt any THREE of the following : 12

- (a) With a neat sketch describe protection scheme of an alternator against inter-turn fault.
- (b) What is meant by Basic Insulation Level (BIL) ? Explain its significance in insulation co-ordination of power system.
- (c) Explain the process of arc development and its extinction in vacuum circuit breaker.
- (d) State the principle of distance protection. What are the advantages of distance protection over other types of protection of feeders.

(B) Attempt any ONE of the following : 6

- (a) Explain with the help of sketches the working of protection schemes for motor against.
 - (i) Overload
 - (ii) Phase failure
- (b) Why special attention is required for bus-bar protection ? With a neat sketch explain the fault bus protection scheme.

5. Attempt any FOUR of the following : 16

- (a) Explain the following terms related to circuit breakers :
 - (i) Rated current
 - (ii) Breaking capacity
 - (iii) Making capacity
 - (iv) Short time current rating.
- (b) Describe the working of earth leakage circuit breaker with a neat diagram.
- (c) Draw a neat labelled sketch of induction type overcurrent relay and explain how pick-up current is changed by plug setting.
- (d) Why biasing is needed in differential relays ? What is meant by percentage bias ?
- (e) Explain with a neat sketch the operation of attracted armature type relay. Also give its two merits and demerits.

- (f) Determine the time of operation of a 1A, 3 seconds overcurrent relay having plug setting of 125% and a time multiplier of 0.6. The supplying CT is rated 400:1 A and fault current is 4000 A. The relay characteristics is as given below :

PSM	1.3	2	4	8	10	20
Time of operation in seconds	30	10	5	3.3	3	2.2

6. Attempt any FOUR of the following :

16

- (a) Describe 'Restricted Earth Fault Protection' of a star connected, neutral earthed side of power transformer.
- (b) Describe the working principle of MHO relay with the help of a neat diagram.
- (c) The neutral point of a three phase 20 MVA, 11 kV alternator is earthed through a resistance of 5Ω . The relay is set to operate when there is an out of balance current of 1.5 A. The CTs have a ratio of 1000/5. What is the percentage of winding protected ?
- (d) What are the faults likely to occur in a power transformer ? What do you mean by incipient faults and through faults ?
- (e) Explain the principle of time graded protection of feeders using IDMT overcurrent relays.
-