

17508

16117

3 Hours / 100 Marks

Seat No.

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- 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 overcome ?
- (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.
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