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3 Hours / 70 Marks Seat No. ☐☐☐☐☐☐☐☐

15 minutes extra for each hour

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

   a) Define normal and abnormal conditions in electrical power system.

   b) State the need of current limiting reactors.

   c) Define
      i) Breaking capacity and
      ii) Making capacity of circuit breakers

   d) Define terms selectivity and reliability of protective relays.

   e) State any four faults that may occur in alternator.

   f) State any four faults that can occur in motor.

   g) List any two protection schemes used for the transmission line.

2. **Attempt any <u>THREE</u> of the following:**   **12**

a) State any four types of faults and their causes in electrical power system.

b) Define the terms:

   i)   A/C voltage

   ii)   Recovery voltage

   iii) Restriking voltage

   iv)   RRRV for circuit interrupting devices.

c) State PSM and TSM for protective relays and name the relay in which PSM and TSM are applicable.

d) A three phase, 11 KV/400 V, 50 Hz, Δ/λ (delta/star) transformer has CT of ratio 200/5 on I.V. side. Calculate the CT ratio on H.V. side (i.e. 11 KV side).

3. **Attempt any <u>THREE</u> of the following:**   **12**

a) Four 11 KV, three phase, 5 MVA alternators having reactance of 20% each operate in parallel and supply power to 25 MVA, 3 phase transformer of ratio. 11 KV / 132 KV. The transformer % reactance is 2.5%. Calculate the fault KVA on H.V. side of transformer.

b) Compare simple KitKat fuse with MCB for

   i)   Reliability

   ii)   Braking capacity

   iii) Cost

   iv)   Applications.

c) Draw the block diagram of static relay and state its working principle.

d) With neat line diagram, state the working of over current and earth fault protection of alternator.

Marks

4. Attempt any THREE of the following: 12

  a) State the principle and working of single phase ELCB (Earth Leakage Circuit Breaker) with neat circuit diagram.

  b) State the working principle of directional power relay with neat diagram.

  c) State the working principle of Bucholz relay. Draw sketch of Bucholz relay.

  d) State the working principle of differential protection for bus bar with single line diagram.

  e) State the working of fault bus protection scheme with neat sketch.

5. Attempt any TWO of the following: 12

  a) With the help of neat sketch, state the construction and working of SF_6 gas circuit breaker.

  b) Draw block diagram and state sequence of operation of ϕ microprocessor based over current protection.

  c) A three phase, 2 pole, 10,000 KVA alternator has neutral earthed through resistance of 7Ω. The machine (alternator) has current balance protection which operated upon out of balance current exceeding 20% of full load. Determine percentage of winding protected against earth fault.

Marks

6. **Attempt any TWO of the following:** 12

a) Draw neat sketch of pantograph type of isolator. State the sequence of operation of circuit breaker, isolator and earthing switch while opening and closing.

b) State following three basic relay terminologies

   i)   Relay time

   ii) Pick up

   iii) Reset and

   Define

   i)   Instantaneous relay

   ii) Over current relay

   iii) Differential relay

c) With the help of neat sketch, state the operation of distance protection scheme for the transmission line.

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