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## Seventh Semester B.E. Degree Examination, June/July 2024

## Power System Protection

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With a neat diagram, explaining the zones of Protection in a Power System. (06 Marks)  
 b. List the advantages and disadvantages of Static relays. (06 Marks)  
 c. Derive an expression for torque produced by an induction relay. (08 Marks)

OR

- 2 a. List and explain the essential qualities of a protective relays. (08 Marks)  
 b. How Protective relays are classified? List them. (06 Marks)  
 c. Explain the classification of Protective schemes. (06 Marks)

Module-2

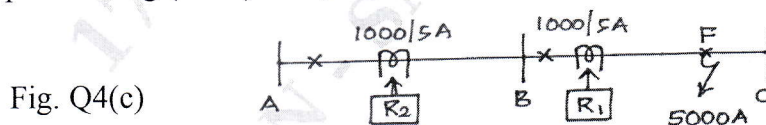
- 3 a. Draw and explain the circuit connections of three MHO units used at a particular location for three zones of protection. (07 Marks)  
 b. With neat connection diagrams, explain the working of directional earth fault relay. (07 Marks)  
 c. With neat diagram, explain Static impedance relay using amplitude comparator. (06 Marks)

OR

- 4 a. With a neat schematic diagram, explain the construction and working of reactance relay. (06 Marks)  
 b. Discuss the effect of power surges on the performance of different type of distance relay. (08 Marks)  
 c. Two relays  $R_1$  &  $R_2$  are connected in two sections of a feeds as shown in Fig, Q4(c). CT's are of ratio 1000/5A. The plug setting of relay  $R_1$  is 100% and  $R_2$  is 125%. The operating time characteristics of the relay is as given table.

$P_{SM}$	2	4	5	8	10	20
Operating time in seconds	10	5	4	3	2.8	2.4

The time multiplier setting of the relay  $R_1$  is 0.3. The time grading scheme has discriminative time margin of 0.5s between the relays. A 3- $\phi$  short circuit at F results in a fault current of 5000A. Find the actual operating times of  $R_1$  and  $R_2$ . What is the time multiplier setting (TMS) of  $R_2$ . (06 Marks)

Module-3

- 5 a. With neat diagram, explain harmonic restraint relay used to protect against magnetizing inrush current of transformer. (08 Marks)  
 b. Define the term 'Pilot' with reference to power line protection. List the different types of wire pilot protection schemes and explain any one of the schemes. (08 Marks)  
 c. With neat circuit diagram, explain rotor earth fault protection of alternator. (04 Marks)

OR

- 6 a. With a neat diagram, explain the working of Buchholz relay. (06 Marks)  
 b. With schematic diagram, explained (opposed) voltage differential protection. (06 Marks)  
 c. With a neat sketch, explain the working of frame leakage protection used for bus zone protection. (08 Marks)

**Module-4**

- 7 a. Explain the working of SF6 circuit breaker with the help of diagrams. Write two of its advantages. (08 Marks)  
 b. With a neat sketch, explain the recovery rate theory and energy balance theory of arc interruption in a circuit breaker. (06 Marks)  
 c. For a 132KV system, the reactance and capacitance upto the location of the circuit breaker is  $3\Omega$  and  $0.015\mu F$ , respectively. Calculate the following :  
 i) The frequency transient oscillation.  
 ii) The maximum value of restriking voltage across the contacts of the circuit breaker.  
 iii) The maximum value of RRRV. (06 Marks)

OR

- 8 a. With neat circuit diagram, explain the synthetic testing of circuit breaker. (06 Marks)  
 b. With neat diagram, explain Air – break circuit breaker. Write any two its applications. (06 Marks)  
 c. Derive expressions for restriking voltage and RRRV on terms of System voltage, Inductance and Capacitance during fault on feeder. (08 Marks)

**Module-5**

- 9 a. Explain the modules / components of Gas Insulated Substations (GIS). (06 Marks)  
 b. With a neat sketch, explain the construction and working of Lichtenberg figures and Magnetic links. (06 Marks)  
 c. With a neat figure, explain the working of i) Rodgap arrestor ii) Expulsion type arrestor. (08 Marks)

OR

- 10 a. Describe the phenomenon of lighting and explain the terms pilot streamer, stepped leader, return streamer, dart leader, cold lighting stroke and hot lighting stroke. (08 Marks)  
 b. Describe the construction and operation of the HRC cartridge fuse with indicator. Write any four of advantages of HRC fuses. (08 Marks)  
 c. Write a short note on Arcing horn with diagram. (04 Marks)

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