Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER 2013

Subject Code: 170903 **Date: 07-12-2013**

Subject Name: Power System Protection

Time: 10:30 TO 01:00 **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Describe with a neat sketch the operating principle of an inverse type over current relay. How do plug settings control the pick- up current of such a relay? **07**

(b) A radial feeder ABC is sectionalized into parts AB and BC. Part AB near the source, has a relay R_2 and part BC at the far end has a relay R_1. R_1 is set on 125 % and R_2 is set on 150 % plug setting. CT ratios for both the relays is 500/1. For discrimination, a time gradient margin of 0.5 sec is taken. Determine the time of operation of both the relays when a fault occurs at the end of the feeder section BC. The fault current is 5000 A.TMS of R_1 is 0.2 Determine TMS of R_2. Both the relays follow the characteristics given below. **07**

PSM	2	3.6	5	6.6	8	10	15
Time for TMS=1(Secs)	10	6	3.9	3.5	3.15	2.8	2.2

Q.2 **(a)** Describe the block diagram of equipments used in carrier phase comparison scheme. **07**

(b) Explain the working principle of induction type electromagnetic relays. **07**

OR

(b) Explain the method of protecting bus bars using differential relaying. What are the limitations of this method and to what extent can these be overcome. **07**

Q.3 **(a)** Give the protection scheme for a large 3 phase induction motor. **07**

(b) Describe essential features of a protective system with reference to **07**

1. Discrimination. 2. Stability. 3. Reliability.

OR

Q.3 **(a)** Why is back up protection required? Discuss different types of back-up protections used. **07**

(b) What is loss of excitation in a generator? What protection is provided for it? **07**

Q.4 **(a)** Discuss the 3 zone protection of transmission lines using impedance relays explaining as to how the 1st zone relay is set to avoid over reach and the 2nd zone relay is set to avoid under reach. **07**

(b) What are incipient faults? Discuss the type of protection provided in transformers to cater to such type of faults. **07**

OR

Q.4 **(a)** Discuss the method followed to make the differential relays immune to magnetizing inrush current? **07**

(b) What protective scheme is used for the protection of parallel feeders and ring main system. **07**

Q.5	**(a)**	Draw the block diagram of a numerical relay and explain the working of each block.	**07**
	(b)	Which special tests are carried out on a relay? Explain any two of them.	**07**

OR

Q.5	**(a)**	What is the difference between an earth fault relay and an over current relay? Discuss various methods to energize an earth fault relay.	**07**
	(b)	Explain restricted earth fault protection in an alternator.	**07**

The neutral point of a three phase, 20 MVA, 11 kV alternator is earthed through a resistance of 5 Ω. The relay is set to operate when there is an out of balance current of 1.5 A. The CT's have a ratio of 1000/5. What percentage of the winding is protected against an earth fault. What should be the minimum value of the earthing resistance to protect 90 % of the winding.

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