

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE SEM-VII Examination-Nov/Dec.-2011****Subject code: 170903****Date: 24/11/2011****Subject Name: Power System Protection****Time: 10.30 am-01.00 pm****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)****07**

Relay R in Fig. 1 is one of the IDMT phase overcurrent relay of three overcurrent and one earth fault scheme having normal inverse characteristic. It is connected on 132 kV transmission line with its normal plug setting range 50–200% of 1 A in step of 25%. The time dial setting (TDS) range of relay R is 0.1 to 1 s in steps of 0.05 s. The CT ratio is 500/1 A. If load on the 132 kV line is 100 MW with 0.98 power factor then determine plug setting (PS) of the relay R. Further, if phase-to-phase fault occurs at 50 km from the relay with a magnitude of 4000 A, determine its time of operation using standard relay formula. Assume set value of TDS of relay R is 0.5.

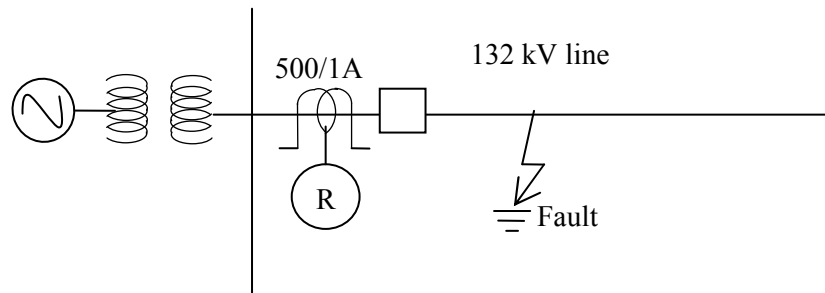


Fig. 1 Single line diagram of a portion of power system network

**(b)****07**

Explain how thermal overload relay is used for the protection of equipment against overloading condition. Is it possible to use overcurrent relay in place of overload relay? Justify your answer.

**Q.2 (a)****07**

Why are instantaneous overcurrent relays alone not capable to protect transmission line? Also discuss relative merits and demerits of instantaneous overcurrent relays.

**(b)****07**

Explain the following requirements of protection system.

- (i) Selectivity (ii) Reliability (iii) Security (iv) Speed
- (v) Discrimination (vi) Sensitivity (vii) Economics

**OR****(b)****07**

Draw a schematic diagram of primary protection zone of various equipments. Also explain the difference between primary and back-up protection.

- Q.3 (a) 07**  
 Explain reach, overreach and underreach phenomenon with reference to distance relay. Also explain how back-up protection is achieved in a distance relay using step distance characteristics.
- (b) 07**  
 What is the need for a pilot protection scheme even though distance protection schemes are widely used in the field?
- OR**
- Q.3 (a) 07**  
 Draw a schematic diagram of a phase comparison carrier current protection scheme and explain the main carrier equipments used in this scheme.
- (b) 07**  
 Explain the working of carrier aided under reach transfer tripping scheme using time-distance characteristic and control circuit.
- Q.4 (a) 07**  
 Explain with schematic diagram the working of circulating current differential protection scheme for generator. Also discuss various disadvantages of this scheme with possible remedy.
- (b) 07**  
 What are the conditions which lead to incipient faults in transformer? What type of protection is required? Also explain the working of gas operated relay.
- OR**
- Q.4 (a) 07**  
 Explain with three phase diagram the philosophy of biased differential protection scheme for two winding delta-star transformer. Also discuss how the problems of phase shift from LV winding to HV winding transformer and tapping in power transformer is overcome using the above scheme.
- Q.4 (b) 07**  
 Explain the need of following protections in an induction motor.  
 (i) Unbalanced currents  
 (ii) Stalling
- Q.5 (a) 07**  
 With the help of schematic diagram, discuss various components of digital/numerical relays.
- (b) 07**  
 Why is testing of each relay required to be carried out? Also discuss various type tests and special tests to be performed on a relay.
- OR**
- Q.5 (a) 07**  
 Explain the importance of sampling with reference to digital/numerical relay. Also provide comparison between FIR filter and IIR filter.
- (b) 07**  
 Discuss various types of installation/acceptance and commissioning tests to be performed on a relay.

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