Sixth Semester B.E. Degree Examination, June/July 2016
Switchgear and Protection

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer any FIVE full questions, selecting*
atleast TWO questions from each part.
2. *Missing data, if any, may be suitably assumed.*

PART – A

1   a. State any five differences between a circuit breaker and a fuse.   **(05 Marks)**
   b. With a neat sketch explain the construction and working of a HRC fuse.   **(08 Marks)**
   c. In a 220 KV system having a line to ground capacitance of $0.015\ \mu F$ and an inductance of 3.5H, determine the voltage appearing across the pole of the circuit breaker if a magnetizing current of 6.5A (instantaneous) is interrupted. Determine also the value of the resistance to be used across the contacts to eliminate the restriking voltage.   **(07 Marks)**

2   a. Explain the principle of DC circuit breaking indicating the V – I characteristics and relevant operating zones.   **(05 Marks)**
   b. For a 132 KV system, the reactance and capacitance up to the location of the circuit breaker is 3 Ω and $0.015\ \mu F$ respectively. calculate :
     i) Frequency of transient oscillation
     ii) Maximum value of restriking voltage across breaker contacts
     iii) Maximum RRRV.   **(07 Marks)**
   c. A 50 Hz 3 – phase alternator with grounded neutral has an inductance of 1.6 mH per phase and is connected to bus bar through a circuit breaker. The capacitance to earth between the alternator and circuit breaker is $0.003\ \mu F$ per phase. The circuit breaker opens when rms value of current is 7500A. Determine : i) Maximum RRRV ii) time for maximum RRRV iii) Frequency of oscillations.   **(08 Marks)**

3   a. Explain the working of an air blast circuit breaker with reference to :
     i) Axial blast ii) cross blast.   **(08 Marks)**
   b. Name any ten significant advantages of SF_6 breakers.   **(06 Marks)**
   c. Explain short circuit breaker test layout with a single line diagram.   **(06 Marks)**

4   a. What are the advantages of synthetic testing of circuit breakers?   **(08 Marks)**
   b. Explain direct and indirect lightening strokes.   **(08 Marks)**
   c. State any four essential requirements of a 'Surge Diverter'.   **(04 Marks)**

PART – B

5   a. With a diagram, explain the zones of protection in a typical power system.   **(08 Marks)**
   b. Name any six essential characteristics of a protective relay.   **(06 Marks)**
   c. Determine the actual time of operation of a 5A, 3 second over current relay having a current setting of 125% and a time multiplier of 0.6 connected to a supply circuit through a 400/5 CT when the circuit carries a fault current of 4000A. The operation time of the relay is 3.5 sec. for the estimated value of PSM.   **(06 Marks)**

6   a. Describe the operation of the following relays with neat sketches :
     i) shaied pole type induction relay ii) watt hour meter type induction relay.   **(12 Marks)**
   b. Explain the working principle and characteristics of an impedance relay.   **(08 Marks)**
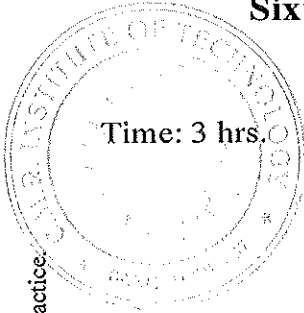
7   a.   Explain the Merz – Price protection for Y – connected alternator. What are the advantages?
                                                                                    (10 Marks)
    b.   A synchronous generator rated for 20 KV protected by circulating current system having neutral grounded through a resistance of 15Ω. The differential protection relay is set to operate when there is an out – of – balance current of 3A. The CTs have a ratio of 1000/5A. Determine,
         i) Percentage of unprotected winding
         ii) Value of earth resistance to achieve 75% protection of winding.   (10 Marks)

8   a.   Explain the working of a Buchholtz's relay for transformer protection with neat diagram.
                                                                                    (10 Marks)
    b.   Explain single phasing preventer for induction motor with a diagram.   (10 Marks)

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