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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 $0.015 \mu\text{F}$ 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 3Ω and $0.015 \mu\text{F}$ 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 1.6mH per phase and is connected to bus bar through a circuit breaker. The capacitance to earth between the alternator and circuit breaker is $0.003 \mu\text{F}$ 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 lightning 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) shaded 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,
- Percentage of unprotected winding
 - 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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