USN | | | | | | | | | | |

10EE62

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 μF 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 μF 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 μF 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 sat 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)**

* * * * *

USN | 1 | H | N | 1 | 2 | E | E | 0 | 0 | 5 | 10EE62

Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Switchgear and Protection

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Explain the construction and working of a HRC fuse with a neat sketch. List the advantages and disadvantages. (10 Marks)

b. Write a short note on energy management of power. (05 Marks)

c. Explain difference between isolating switch and load breaking switch. (05 Marks)

2 a. What is Resistance switching? Derive an expression for critical value of resistance to be added to circuit breaker. (08 Marks)

b. Explain in detail, two theories of arc interruption in circuit Breakers. (06 Marks)

c. In a 132KV system, the reactance and capacitance up to the location of the circuit breaker is 3Ω and 0.015 respectively. Calculate the following :
i) The frequency of transient oscillation
ii) Maximum value of restriking voltage across the contacts of the circuit Breaker and
iii) Maximum value of rate of rise restriking voltage. (06 Marks)

3 a. Explain the working of an air blast circuit breaker with reference to
i) Axial blast ii) Cross blast (12 Marks)

b. Explain the properties of SF_6 gas. (08 Marks)

4 a. With a neat diagram explain the short circuit test on circuit breaker. (08 Marks)

b. With a neat diagram, explain any one type of synthetic testing of circuit Breaker. (06 Marks)

c. Explain the phenomenon of lightning discharge. (06 Marks)

PART – B

5 a. Explain the concept of primary and back up protection. (06 Marks)

b. What are the essential qualities of a protective relay? Explain them briefly. (10 Marks)

c. What is Relay? Define : i) Pickup level ii) burden iii) dropout with respect to relays. (04 Marks)

6 a. With a neat sketch, explain the working of induction type directional over current relay. (10 Marks)

b. Explain with a neat circuit, the working of voltage balance differential relay. (05 Marks)

c. Explain the working principle of an impedance Relay. (05 Marks)

7 a. Draw and explain the Merz – Price protection of alternator stator windings, state its advantage (Y and Δ connected alternators). (10 Marks)

b. A 6.6KV, star connected alternator has a transient reactance of 2Ω per phase and negligible winding resistance. It is protected by circulating current Merz – Price protection. The alternator neutral is earthed through the resistance of 7.5Ω. The relays are set to operate when there is out of balance current of 1 ampere in secondary of 500/5 amper current transformers. How much % of winding is protected against earth fault? (10 Marks)

8 a. With the basic circuit diagram, explain the harmonic restraint relay protection for a transformer. (08 Marks)

b. Explain single phasing in induction motors. How motor is protected from single phasing. (08 Marks)

c. List the various abnormal conditions against which large induction motor has to be protected.. (04 Marks)

* * * * *

USN | 2 | H | N | 1 | 2 | E | E | 0 | 2 | 5 |

10EE62

Sixth Semester B.E. Degree Examination, June/July 2015

Switchgear and Protection

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define switchgear, Distinguish between isolating and load breaking switch. **(04 Marks)**

b. Explain why silver is used as fuse material inspite of its high cost. **(06 Marks)**

c. With a neat sketch explain the construction and working principle of HRC fuse with tripping device. **(10 Marks)**

2 a. Explain the current interruption in A.C circuit breakers with neat waveforms and define the terms restriking voltage and recovery voltage. **(10 Marks)**

b. With a neat diagram and necessary waveforms, explain the phenomenon of interruption of capacitive currents in a circuit breaker. **(10 Marks)**

3 a. With a neat sketch explain the construction and working of minimum oil circuit breaker. **(10 Marks)**

b. With a neat circuit diagram explain the short circuit test layout on circuit breakers. **(10 Marks)**

4 a. Explain the working principle, disadvantages and advantages of horn – gap arrestors. **(10 Marks)**

b. What are the types of lightning strokes? Explain each of them. **(06 Marks)**

c. Distinguish between fuse and circuit breaker. **(04 Marks)**

PART – B

5 a. Explain the essential qualities of protective relaying. **(10 Marks)**

b. With a neat diagram explain the zones of protection in typical power system. **(10 Marks)**

6 a. With a neat sketch, explain the principle of three stepped distance protection of transmission line. **(10 Marks)**

b. Differentiate between IDMT overcurrent relay and extremely inverse time overcurrent relay characteristics. **(04 Marks)**

c. Determine the actual time of operation of a 5A, 3seconds overcurrent relay having a current setting of 125% and a time setting multiplier of 0.6 connected to supply circuit through a 400/5 current transformer when the circuit carries a fault current of 4000A. Time of operation is 3.5s for the estimated value of PSM. **(06 Marks)**

7 a. Explain the protection scheme for stator inter turn faults and rotor earth fault of a generator. **(10 Marks)**

b. Describe the loss of excitation protection in a generator and its characteristics. **(10 Marks)**

8 a. With a neat circuit diagram, explain the Merz – price protection scheme for star – delta transformers. **(10 Marks)**

b. With a neat circuit diagram explain single phasing preventer used for Induction motor. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE62

Sixth Semester B.E. Degree Examination, June/July 2014
Switchgear and Protection

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. Draw the block diagram of energy management of power system and explain. (10 Marks)

b. With neat sketch describe the working principle of a liquid fuse. (06 Marks)

c. With neat sketch explain cut off characteristics of HRC fuse. (04 Marks)

2 a. Discuss the recovery rate theory and energy balance theory of arc interruption in a.c. circuit breaker. (10 Marks)

b. Discuss the phenomenon of inductive current chopping in a circuit breaker. (10 Marks)

3 a. Explain the working of air blast circuit breaker with reference to i) Axial blast; ii) Cross blast. (10 Marks)

b. With neat sketch explain the construction and working of non-puffer type SF_6 breaker. (10 Marks)

4 a. With neat circuits explain two types of synthetic test on circuit breakers. (10 Marks)

b. With a neat sketch, explain expulsion type lightning arrester. What are the advantages and disadvantages of the above? (10 Marks)

PART – B

5 a. Explain the concept of primary and back up protection. (06 Marks)

b. Explain with the help of neat diagram, the construction and working of non directional induction type over current relay. Draw and explain its time current characteristics. (10 Marks)

c. The current ratings of an over current relay is 5A. It has a PSM = 2, TSM = 0.3. CT ratio = 400/5, Fault current = 4000A. Determine the time of operation of the relay assuming normal IDMT characteristics. (04 Marks)

PSM	2	4	5	8	10	20
Operating time (s)	10	5	4	3	2.8	2.4

6 a. Explain the construction, working, torque equation and operating characteristics of reactance relay. (10 Marks)

b. With a neat sketch, explain the construction and working of Buchholz relay. (10 Marks)

7 a. Which are the abnormal running conditions may exists in a generator? Explain in brief. (10 Marks)

b. The natural point of a 11kV alternator is earthed through a resistance of 12Ω, the relay is set to operate when there is out of balance of 0.8A. The C.T.S. have a ratio of 2000/5. What percentage of the winding is protected against earth faults? What must be the minimum value of earthing resistance required to give 90% of protection to each phase? (10 Marks)

8 a. With a basic circuit diagram, explain harmonic restraint relay protection for transformer. (10 Marks)

b. With the relevant Sketches explain i) Ground fault protection; ii) Phase fault protection of induction motor. (10 Marks)

* * * * *