Switchgear Protection VTU Question Paper Set 2017

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10EE62

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Switch Gear 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. State and explain fuse law. With a neat sketch explain the time–current and cut–off characteristics of HRC fuse. **(10 Marks)**

b. Draw and explain a line diagram of substation with use of isolating switches. Mention operating instructions and applications of isolating switches. **(10 Marks)**

2 a. What are Slepian's and Cassie's theorem of arc interruption? Explain with neat sketches. Also explain low resistance or zero point extinction. **(10 Marks)**

b. How interruption of capacitive currents takes place in AC circuit breakers? Explain. **(10 Marks)**

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

b. Describe the working principle of SF_6 circuit breaker with the help of a neat sketch. mention the advantages over other type of circuit breakers. **(10 Marks)**

4 a. Explain the construction and working of a vacuum circuit breaker. **(10 Marks)**

b. Describe : i) unit testing ii) synthetic testing of a circuit breaker. **(10 Marks)**

PART – B

5 a. What are the requirements of protective relaying? And discuss i) zones of protection ii) primary and back–up protection. **(10 Marks)**

b. Briefly explain the essential qualities and classification of protective relays. **(10 Marks)**

6 a. Explain in detail with the help of a neat figure the working of non–directional induction type over–current relay. **(10 Marks)**

b. Explain the principle of working and operating characteristics of a percentage biased differential relay. **(10 Marks)**

7 a. What are the important faults that can occur in an alternator during operation? Explain in detail. **(10 Marks)**

b. A generator is protected by restricted earth fault protection. The generators ratings 13.2 KV, 10 MVA. The percentage of winding protected against phase to ground fault is 85%. The relay setting is such that it trips for 20% out of balance. Calculate the resistance to be added in the neutral to ground connection. **(10 Marks)**

8 a. With a neat sketch explain the working of a Buchholz relay for transformer protection and state its limitations. **(10 Marks)**

b. A three phase power transformer having a line voltage ratio of 400 V to 33 KV is connected in star–delta. The CTs on 400 V side have current ratio as 1000/5. What must be the CT ratio on 33 KV side? Show the star–delta arrangement with CT connections. Assume current on 400 V side of transformer to be 1000 A. **(10 Marks)**

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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)**

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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)**

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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)**

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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)**

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