



**KINGS**

COLLEGE OF ENGINEERING



**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

## **QUESTION BANK**

**SUBJECT CODE & NAME : EE 1302 – PROTECTION & SWITCHGEAR**

**YEAR / SEM : III / V**

### **UNIT – I**

#### **INTRODUCTION**

##### **PART – A**

1. What are the protective zone of the power system? (2)
2. List the functional characteristics that a protective relay is required to satisfy. (2)
3. What is meant by Switchgear? (2)
4. What are the functions of Protective relaying? (2)
5. What is back up protection? (2)
6. What is known as unsymmetrical fault? (2)
7. What is plug setting multiplier? (2)
8. Give at least two merits of resistance Grounded system (2)

##### **PART – B**

1. i) Draw the protective zone diagram for a sample power system network and system in rules. (8)  
ii) A 3-phase 11 kV, 25000 kVA alternator with  $X_{go} = 0.05$  p.u,  $X_1 = 0.15$  p.u and  $X_2 = 0.15$  p.u is grounded through a reactance of 0.3 ohm. Calculate the line current for a single line to ground fault. (8)
2. i) List the causes of faults in different equipments in a sample system. (8)  
ii) Explain arc – suppression coil earthing with a diagram. (8)

3. In a 3-phase 4- wire system , the currents RYB under abnormal conditions of loading are as under
- $$I_R = 100 \angle 30^\circ \text{A}$$
- $$I_Y = 50 \angle 300^\circ \text{A}$$
- $$I_B = 30 \angle 180^\circ \text{A}$$
- Calculate the positive, negative and zero sequence currents in R line and current in return wire. (16)
4. Describe the symmetrical components method to analyze an unbalanced system. (16)
5. (a) (i) What are the causes of short circuits due to failure of insulation on overhead conductors. (4)
- (ii) Briefly Explain about
- (ii) Resistance ear thing
- (iii) Reactance ear thing (12)
6. (i) What are the desirable qualities of protection relaying? (8)
- (ii) Discuss the consequence of faults on a power system. (8)

### UNIT – II

#### **OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS**

#### PART – A

1. What is meant by time setting multiplier in protective relay? (2)
2. What is the role of comparator in long distance transmission line protection? (2)
3. For what purpose distance relay is used. (2)
4. Give any two advantages of static relays over electromagnetic relays. (2)
5. Define the terms (a) pick up value (b) plug setting multiplier. (2)
6. What are the advantages of percentage differential relay over a simple differential relay (2)
7. What is comparator? What are all its types? (2)
8. What are IDMT characteristics of a relay? (2)
9. What meant by Frequency relay? (2)

**PART – B**

1. Draw the characteristics of the following distance relays in the R-X diagram and explain.
  - i) Mho – relay
  - ii) Reactance relay (16)
2.
  - i) Draw the constructional details of non-directional inductance relay. (8)
  - ii) Draw and explain the schematic of an impedance relay and its operating characteristics on R-X diagram (8)
3.
  - i) Explain the principle of current differential relay with diagram(8)
  - ii) List the advantages of Static relays(8)
4. Explain the construction, working principle and characteristics of reactance relay type distance relay. (16)
5. Describe the construction and principle of operation of induction type directional over current relay. (16)

**UNIT – III**

**APPARATUS PROTECTION**

**PART – A**

1. A 3-phase 220V / 11000V transformer is connected in star – delta and the protective transformers on the 220V side is having a current ratio of 600 / 5. What must be the ratio of CTs on the 11000v side? (2)
2. What are two types of protection given for bus-bars? (2)
3. What is the meaning of burden on C.T? (2)
4. List the abnormal condition in a transformer against which protection is necessary. (2)
5. What are the common methods used for line protection? (2)
6. Mention the difference between CTs used for protection and measurement (2)
7. Differentiate between potential Transformers. And current Transformers? (2)
8. What are the applications CTs and PTs in power system? (2)

**PART – B**

1. Write a notes on the following
  - i) Buchholz relay (8)
  - ii) Use of Impedance relay on Transmission line protection. (8)
  
2.
  - i) What are the faults that may occur on an alternator? Give the diagram for circulating current protection in alternator. (8)
  - ii) A 5000 kVA, 6600V star connected alternator has a synchronous reactance of 20 ohm per phase 0.5 ohm resistance. It is protected by Merz – price balance current system which operates when the out of balance current exceeds 30 % of the load current. Determine what proportion of the alternator winding is in protected of the star point is earthed through a point of 6.5 ohm. (8)
  
3.
  - i) Describe the Merz-price circulation current scheme pf protection used for power transformer. (8)
  - ii) A three phase 220V / 11kV transformer is connected star / delta and CT on 200V side have a current ratio of 600 / 5 / 53. What must be the ratio of CT on 11 kV side and how should they be connected? (8)
  
4.
  - i) Explain how ring main feeders are protected by graded time lag differentia relays. (8)
  - ii) Distinguish between over load protection and short circuit protection of a motor. (8)
  
5. (a)
  - (i) Draw and Explain protection scheme of an A.C 3 phase induction motor? (8)
  - (ii) A 6.6KV star connected alternator ahs a transient reactance of  $2\Omega$  per phase and negligible resistance. It is protected by circulating current merz price protection. The alternator neutral is earthed through the resistance of  $7.5\Omega$ . The relays are set to operate when there is one of balance current of 1A un secondary of 500/5A CTs. How much % of winding in protected against ear thing fault? (8)
  
6.
  - (i) What is importance of bus bar protection? And explain one scheme of bus bar protection. (8) `
  - (ii) How many faults develop in power transformer? (8)

**UNIT – IV**

**THEORY OF CIRCUIT INTERRUPTION**

**PART – A**

1. What is current chopping relates arc quenching? (2)
2. Why dc circuit breaking is difficult compared with ac circuit breaking? (2)
3. Define recovery voltage. (2)
4. Define rate of rise of restriking voltage. (2)
5. How is arc initiated across the contacts of CB (2)
6. Mention the theories that explain the phenomenon of arc extinction. (2)
7. List the factors on which the arc resistance depends. (2)
8. What is an arc? (2)

**PART – B**

1. i) Discuss on resistance switching. (8)  
ii) Explain successive restriking and current chopping as applied to interruption of capacitive and low induction currents. (8)
  
2. (i) A 50 cycles, 3 phase alternator with grounded neutral has inductance of  $1.6 \Omega$  H per phase and in connected t 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 7500A.  
Determine the following  
(i) Maximum rate of rise of restriking voltage.  
(ii) Time for maximum rate of rise of restriking voltage.  
(ii) Frequency of oscillations.  
Neglect first pole to clear factor. (8)
  
- (ii) Explain D.C circuit Braking. (8)
  
3. (a) A  $50\text{H}_z$  11KV 3 phase alternator with earthed neutral has a reactance of  $50\text{hm}$  per phase and in connected to a bus – bar through a circuit breaker the distributes capacitance up to the circuit breaker between phase and neutral in  $0.001\mu\text{F}$ . Determine.  
(i) Peak restriking voltage across the circuit breaker.

- (ii) Frequency of oscillations.
- (ii) The average rate of rise of re-striking voltage up to the first peak. (8)
- (b) Explain various arc interruption methods used in circuit Breaker. (8)
- 4. Explain the arc phenomena for initiation of arc, maintenance of arc and the method used for arc interruption. (16)

**UNIT – V**

**CIRCUIT BREAKERS**

**PART – A**

- 1. What are the advantages of air blast circuit breakers? (2)
- 2. What are the major parts of vacuum circuit breakers? (2)
- 3. List the routine tests conducted on circuit breakers. (2)
- 4. Classify different types of circuit breaking. (2)
- 5. What are the disadvantages of oil as an arc quenching medium in CBs. (2)
- 6. What are the disadvantages of plain break oil CB? (2)
- 7. Describe any two merits of vacuum circuit Breaker. (2)

**PART – B**

- 1. i) What are the physical, chemical and dielectric properties of SF<sub>6</sub> gas?(8)  
ii) Explain any type of circuit breaker?(8)
- 2. Explain rupturing capacity, making capacity and short time rating and rated current of the circuit breaker. (16)
- 3. Show view of working portion of a typical low – oil circuit breaker.(one phase) (16)
- 4. Explain the construction and working of double arc extinction chamber axial blast circuit breaker. (ABCB). (16)
- 5. Show the constructional layout of SF<sub>6</sub> breaker and its advantages and disadvantages. (16)

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