

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**NAME OF THE SUBJECT: EE2402 - PROTECTION AND SWITCHGEAR**

**YEAR / SEM: IV / VII**

**UNIT – I**  
**INTRODUCTION**  
**PART – A**

1. State the significance of double line fault.
2. Define negative sequence component.
3. State the different types of faults.
4. State the various types of unsymmetrical faults.
5. Mention the withstanding current in our human body.
6. State the various types of earthing.
7. What are the causes of faults?

**PART - B**

1. (a) What are the causes of over voltage on a power system? (6)  
(b) Why is it necessary to protect the lines and other equipment of the power system against over Voltages. (6)  
(c) What are the methods to reduce this resistance? (4)
2. (a) What is necessity of protecting electrical equipment against traveling waves? (6)  
(b) Describe in brief the protective devices used for protection of equipment against such waves? (10)
3. Describe the protection of stations and sub-stations against direct lightning stroke. (16)
4. Describe the construction and principle of operation of  
(i) expulsion type lightning arrester (8)  
(ii) Value type lightning arrester. (8)
5. What is Peterson coil? What protective functions are performed by this device? (16)
6. Write short notes on the following.  
(i) klydonograph and magnetic link (4)  
(ii) Rod gap (4)  
(iii) Arcing horns (4)

- (iv) Basic impulse insulation level (4)
7. What are the requirements of a ground wire for protecting power conductors against direct lightning stroke? Explain how they are achieved in practice. (16)
8. Determine the inductance of Peterson coil to be connected between the neutral and ground to neutralize the charging current of overhead line having the line to ground capacitive of  $0.15\mu\text{f}$ . If the supply frequency is  $50\text{Hz}$  and the operating voltage is  $132\text{KV}$ , find the KVA rating of the coil. (16)
9. (a) Explain the term insulation coordination. (8)
- (b) Describe the construction of volt-time curve and the terminology associated with impulse-testing. (8)
10. Explain the operation of various types of surge absorbers. (16)

## UNIT – II

### OPERATING PRINCIPLES AND RELAY CHARACTERISTICS

#### PART – A

1. Name the different kinds of over current relays.
2. Define operating time of a relay.
3. Define resetting time of a relay.
4. What are over and under current relays?
5. Mention any two applications of differential relay.
6. What is an under frequency relay?
7. What are the features of directional relay?
8. What is static relay?
9. What are the advantages of static relay over electromagnetic relay?
10. Define a over current relay.
11. Define an undercurrent relay?
12. Mention any 2 applications of differential relays.

#### PART - B

1. Narrate the operating principles of electromagnetic relay and mention its types and characteristics. (16)
2. List the advantages and disadvantages of electromagnetic relay along with applications. (16)
3. What are the kinds of directional relays? Explain each in detail with its construction. (16)
4. How directional relay works? Mention its uses. (16)
5. Explain briefly about directional static over current relay and inverse – time over current relay. (16)
6. What are the relays used for over current protection? (16)
7. Explain about microprocessor based protective relays. (16)
8. Explain about the
  - i) negative sequence
  - ii) Distance relay
  - iii) Static relay
  - iv) Differential relay
  - v) Over current relay

and vi) under frequency relay. (16)

### UNIT III

## APPARATUS PROTECTION

### PART - A

1. What are the various faults that would affect an alternator?
2. Why neutral resistor is added between neutral and earth of an alternator?
3. What is the backup protection available for an alternator?
4. What are faults associated with an alternator?
5. What are the main safety devices available with transformer?
6. What are the limitations of Buchholz relay?
7. What are the problems arising in differential protection in power transformer and how are they overcome?
8. What is REF relay?
9. What is over fluxing protection in transformer?
10. Why bus bar protection is needed?
11. What are the causes of bus zone faults?
13. Mention the short comings of Merz Price scheme of protection applied to a power transformer.
13. What are the various faults to which a turbo alternator is likely to be subjected?
14. Define the term pilot with reference to power line protection.
15. Mention any two disadvantage of carrier current scheme for transmission line only.
16. What are the causes of over speed and how alternators are protected from it?
17. What are the main types of stator winding faults?

### PART - B

1. What is the need for apparatus protection? Explain its basic function. (16)
2. Briefly explain the protection schemes over stator fault of generator protection. (16)
3. Draw and explain about unbalanced stator protection and overload protection of stator. (16)
4. What are effects of loss of excitation? How it is protected? (16)
5. Explain the operation of negative phase sequence protective relay. (16)
6. Explain about A.C motor protection. (16)
7. Explain about bus bar protection with different techniques. (16)
8. What are the needs of instrument transformers? Explain in detail about the operation of measuring CT and protection CT with distinctive sketch. (16)

### UNIT - IV

## THEORY OF CIRCUIT INTERRUPTION

### PART - A

1. What is resistance switching?
2. What is an arc?
3. Give the two methods of arc interruption?
4. What is restriking voltage?
5. What is meant by recovery voltage?
6. What is RRRV?

### PART - B

1. What are the different arc interruption methods? (16)

2. Define arc voltage. Discuss the arc phenomenon in a circuit breaker? (16)
3. What is transient recovery voltage? Explain its characteristics. (16)
4. Derive the expression for rate of rise of restriking voltage. (16)
5. Explain in detail about current chopping phenomenon. (16)
6. Compare DC and AC circuit breaking. (16)

**UNIT – V**  
**CIRCUIT BREAKERS**  
**PART – A**

1. What is circuit breaker?
2. Write the classification of circuit breakers based on the medium used for arc extinction?
3. What is the main problem of the circuit breaker?
4. What are demerits of MOCB?
5. What are the advantages of oil as arc quenching medium?
6. What are the hazards imposed by oil when it is used as an arc quenching medium?
7. What are the advantages of MOCB over a bulk oil circuit breaker?
8. What are the disadvantages of MOCB over a bulk oil circuit breaker?
9. What are the types of air blast circuit breaker?
10. What are the advantages of air blast circuit breaker over oil circuit breaker?
11. What are the demerits of using oil as an arc quenching medium?
12. What is meant by electro negativity of SF<sub>6</sub> gas?
13. What are the characteristic of SF<sub>6</sub> gas?
14. Write the classifications of test conducted on circuit breakers.
15. What are the indirect methods of circuit breaker testing?

**PART - B**

1. What are the different types of electromagnetic relays? Discuss their field of applications. (16)
2. What are the various types of over current relays? Discuss their area of application. (16)
3. Describe the operating principle, constructional features and area of applications of reverse power or directional relay. (16)
4. Describe the construction and principle of operation of an induction type directional over current relay. (16)
5. Explain the working principle of distance relays. (16)
6. Write a detailed note on differential relays. (16)
7. Describe the realization of a directional over current relay using a microprocessor. (16)
8. Derive a generalized mathematical model of distance relays for digital protection. (16)
9. (a) How can digital distance relaying algorithm be implemented on the 8086 Micro processor? (8)  
(b) It is possible to implement these algorithms on the 8085 micro processor? (8)
10. Discuss the recovery rate theory and energy balance theory of arc interruption in a circuit breaker. (16)