**14709**

**B. Tech 6th Semester Examination**

**Switch Gear and Protection**

**EE-6001**

**Time : 3 Hours**                                          **Max. Marks : 100**

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C & D. Section E is compulsory.

## SECTION - A

1. (a) What are the different types of electromagnetic relays? What are their field of applications? (10)

   (b) Describe the principle of operation of an induction type of over current relay. Derive the torque equation. (10)

2. (a) What is an amplitude comparator? How can this be used as a protective relay? Derive the general equation of an electromagnetic relay. (10)

   (b) Explain the term directional. Give the 90 degree method of connecting directional relays. (10)

## SECTION - B

3. Explain what is meant by carrier system of protection? With the help of block diagram discuss how the carrier system of protection works. What is the basis for choice of frequency in power line carrier system? (20)

4. (a) Describe the protection scheme for internal faults in a three phase delta/star connected power transformer.

(10)

(b) The neutral point of a three phase 20 MVA, 11kV alternator is earthed through a resistance of 5 ohms, the relay is set to operate when there is an out of balance current of 1.5 A. The CTs have a ratio of 1000/5. What percentage of winding is protected against an earth fault and what should be minimum value of earthing resistance to protect 90% of the winding.          (10)

**SECTION - C**

5. (a) What are the different types of phase comparators? Describe the coincidence type of phase comparator.

(10)

(b) How the following are used for protection against overvoltages:

(1) Horn gap      (2) Surge absorbers          (10)

6. With the help of neat sketch describe the construction & working of HRC fuse with a tripping device. Also discuss the characteristics of HRC fuse.          (20)

**SECTION - D**

7. (a) Discuss the construction and working of SF6 circuit breaker.          (10)

(b) How circuit breaking is done in HVDC systems?    (10)

8. (a) Explain physics of arc phenomena. On what factors does the arc phenomenon depends?          (10)

(b) A 50 Hz, 11kV, three phase alternator with earthed neutral has a reactance of 5 ohms per phase, and is connected to busbar through a circuit breaker. The capacitance to

earth between the alternator and the circuit breaker is 0.02 μF per phase. Assume the resistance of the generator to be negligible calculate the following:

1) Maximum voltage across the contacts of the circuit breaker.

(2) Frequency of oscillations.

(3) The average rate of rise of restriking voltage up to the first peak. (10)

## SECTION - E

9. (a) Name the main factors that should be taken care of while designing a Substation.

(b) Why silver is preferred as a fuse element in spite of its higher cost?

(c) Why does plain oil circuit breaker have a low speed of circuit interruption?

(d) Back up protection is not a good substitute for better maintenance, Why?

(e) What is the purpose of time graded protection system?

(f) What is differential protection?

(g) What are the faults that are likely to occur in power transformers?

(h) Why the ratio to pick up value is high?

(i) In a 132kV, 3 phase, 50 Hz power system the line to ground capacitance is 0.02μF and inductance is 4.5 H. Determine the resistance to be connected across the contacts to eliminate the restriking voltage.

(j) What is meant by coupling factor? (2×10=20)