Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1. Define:
   i) Pick-up value
   ii) Operating time
   iii) Setting value of a protective relay

2. Write the advantages of static relays over electromagnetic relays.

3. Explain the operating principle of an impedance relay.

4. Draw the simplified block diagram of static inverse time over current relay.

5. With a neat sketch, write the working principle of transverse protection of alternator.

6. What is magnetizing inrush current?

7. In a 132 KV system, the inductance and capacitance upto the location of circuit breaker are 0.4 H and 0.015 μF respectively. Determine the maximum value of restraining voltage across the contacts of the circuit breaker and maximum value of RRRV.

8. What is resistance switching?

9. Write the causes of over voltages.

10. Compare the time-current characteristics of inverse, very inverse and extremely inverse current relays.

PART – B (50 Marks)

11.a) With a neat diagram, explain the protective scheme for ringmain system.

   b) Derive the equation for the Torque developed by induction type relay.

12. Explain stepped time-distance characteristics of three distance relays units used for I, II and III zone protection.

13.a) With a neat diagram explain the percentage differential protection scheme of protection of stator of alternator.

   b) What is magnetizing inrush currents? Discuss the protective scheme which protects the transformer against faults but does not operate incase of magnetizing inrush current.
14. a) Explain how arc is initiated and sustained in a circuit breaker when the circuit breaker contacts separate.  
   b) Discuss two methods of arc interruption in circuit breakers.  

15. a) What is ground wire? How do ground wires protect the overhead lines against direct lightning strokes?  
   b) Describe the construction and principle of operation of value type lightening arrestor.  

16. a) Derive an expression for restriking voltage and rate of rise of restriking voltage of a circuit breaker.  
   b) Why IDMT relays are widely used for over current protection?  

17. Write short notes on:
   a) Buchholz relay and
   b) Rating of circuit breakers