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**Sixth Semester B.E. Degree Examination, Dec. 07 / Jan. 08**  
**Switchgear and Protection**

Time: 3 hrs.

Max. Marks:100

**Note :** 1. Answer any FIVE full questions.  
 2. Any missing data may be suitably assumed.

- 1
  - a. Explain clearly with figure the current interruption in a.c. circuit breaking. Hence define the terms Restriking voltage and Recovery voltage. (08 Marks)
  - b. Derive the expression for R.R.R.V. for circuit breaker. (08 Marks)
  - c. A 50 Hz generator has e.m.f. to neutral 7.5 kV (r.m.s). The reactance of the generator and the connected system is  $4\Omega$  and distributed capacitance to neutral is  $0.01 \mu\text{F}$  with resistance negligible. Find i) Frequency of oscillations ii) R.R.R.V average upto first peak of oscillation. (04 Marks)
- 2
  - a. With waveform explain clearly the interruption of capacitive currents. (06 Marks)
  - b. Explain clearly how the arc is formed and maintained between the contacts of circuit breaker. What are the different methods of arc quenching? Explain. (08 Marks)
  - c. With neat figure, explain Cross Blast type circuit breaker. (06 Marks)
- 3
  - a. With neat figure, explain the construction and working of Non – puffer type  $\text{SF}_6$  breaker. (08 Marks)
  - b. Explain clearly with neat figure minimum oil circuit breaker. (08 Marks)
  - c. Explain clearly the characteristics of fuse. (04 Marks)
- 4
  - a. What is Relay? What are the essential qualities of relay? Explain. (06 Marks)
  - b. Derive the torque equation for Induction type relays. (04 Marks)
  - c. Explain clearly with neat figure the working of non – directional induction type over – current relay. Write the application of over – current relay in power system. (10 Marks)
- 5
  - a. Explain clearly the differential protection scheme and what are the difficulties faced in differential protection scheme. (08 Marks)
  - b. With neat figure, explain Frame – leakage protection of bus – bar. (06 Marks)
  - c. Explain Transley relay with figure. (06 Marks)
- 6
  - a. What are distance relays? Write the classification. (06 Marks)
  - b. Derive the torque equation for impedance relay and explain its operating characteristics on R – X diagram. Prove  $Z = \text{constant}$ . (08 Marks)
  - c. Explain with neat figure the Restricted Earth fault protection of generator. (06 Marks)
- 7
  - a. Explain clearly the Merz – price protection scheme for protection of power transformer connected in star – delta fashion. (10 Marks)
  - b. A 3 – phase transformer having line voltage ratio of 0.4 kV/11 kV is connected in star – delta and protective transformers on the 400V side have a current ratio of 500/5. What must be the ratio of the protective transformers on the 11 kV side? Assume line current on 400V side is 500 Amperes. (10 Marks)
- 8 Write short notes on (any four)
  - a. Buchholz relay
  - b. Negative sequence relay.
  - c. Carrier current protection.
  - d. D.C. circuit breaking.
  - e. Resistance switching. (20 Marks)