

B.E. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-VII  
**PCC-1 / FE104 - Power System Protection**

P. Pages : 2

Time : Three Hours



**GUG/W/23/14245**

Max. Marks : 80

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- Notes :
1. All questions carry equal marks.
  2. Due credit will be given to neatness and adequate dimensions.
  3. Assume suitable data wherever necessary.
  4. Illustrate your answers wherever necessary with the help of neat sketches.
  5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
  6. Answer **five** questions.
  7. Use of nonprogrammable calculator is permitted.

1. a) Explain the phenomenon of current chopping in a circuit breaker. What measures are taken to reduce it? 8
- b) In a 132kv system, the inductance and capacitance upto the location of the circuit Breaker are 0.4H and 0.015f  $\mu$ . Determine. 8
- i) The maximum value of Restriking voltage.
  - ii) The maximum value of RRRV
  - iii) The frequency of transient oscillation

**OR**

2. a) Explain the operation of SF6 circuit breaker with neat circuit diagram and its applications. 8
- b) Explain in brief recovery rate and energy balance theory applicable to current zero interruption. 8
3. a) Derive torque equation for electromagnetic relay. 8
- b) Explain the following properties of relays. 8
- |                  |                    |
|------------------|--------------------|
| i) Speed         | ii) Sensitivity    |
| iii) Selectivity | iv) Discrimination |

**OR**

4. a) Describe the essential properties of protective relaying. 8
- b) Explain the terms primary and backup protection. Give suitable examples. 8
5. a) Explain the effect of arc resistance, line length and source impedance on performance of distance relays. 8
- b) Explain the principle of distance relays stating clearly the difference between impedance relay, reactance relay and MHO relay. 8

**OR**

6. a) Derive the equation for the impedance seen by relay during power swing. Is power swing a fault? Which relay is most suitable for it? **8**
- b) Draw impedance, reactance and MHO characteristic to protect the 100% of the line having  $(4+j8)$  impedance. A fault may occur at any point on the line through a resistance of  $2.5\Omega$ . Determine the maximum percentage of line section which can be protected by each type of relay. **8**
7. a) What are the abnormal conditions in a large synchronous generator against which protection is necessary? **8**
- b) Draw and explain bus bar differential protection. **8**

**OR**

8. a) Draw and explain differential protection scheme for 3 phase  $\Delta - Y$  connected transformer. What are the various difficulties while applying this scheme to transformer? How are these overcome. **8**
- b) An 11kv, 100MVA generator is provided with differential scheme of protection. The percentage of the generator winding to be protected against phase to ground fault is 80% The relay is set to operate when there is 15% out of balance current. Determine the value of resistance to be placed in neutral to ground connection. **8**
9. a) Discuss how amplitude comparator can be converted to phase comparator & vice versa. **8**
- b) Explain with a neat sketch microprocessor based Impedance Relay. **8**

**OR**

10. a) Compare static and electromagnetic Relay. **8**
- b) What do you mean by comparator? Explain integrated type phase comparator. **8**

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