

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

P. Pages : 2

Time : Three Hours



**GUG/W/24/14245**

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. Use of slide rule, Logarithmic tables is permitted.
  5. Non programmable calculator is permitted.

1. a) Explain the terms: 8
- i) Restriking voltage    ii) Recovery voltage
  - iii) RRRV                      iv) Expression of Restriking voltage in terms of system voltage.

- b) Explain in brief recovery rate and energy balance theory applicable to current zero interruption. 8

**OR**

2. Write short notes on following.

- a) Circuit breaker rating. 6
- b) SF6 circuit breaker. 5
- c) Air blast circuit breaker. 5

3. a) Describe the essential properties of protective relaying. 8
- b) Explain the terms primary and backup protection. Give suitable examples. 8

**OR**

4. a) Derive torque equation of electromagnetic relay. 8
- b) Explain Current and Time Setting Multiplier in Relays? How this effect operation of relays. 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**

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|-----------|----|---|----------|
| <b>6.</b> | a) | 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. | <b>8</b> |
|           | b) | Derive the equation for the impedance seen by relay during power swing. Is power swing a fault? Which relay is most suitable for it?  | <b>8</b> |
| <b>7.</b> | 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.  | <b>8</b> |
|           | b) | Draw and explain bus bar differential protection.   | <b>8</b> |

**OR**

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|-----------|----|--|----------|
| <b>8.</b> | a) | What are the abnormal conditions in a large synchronous generator against which protection is necessary? | <b>8</b> |
|           | b) | Explain Inrush Current Phenomenon in Transformers with neat diagrams and mathematical equations.         | <b>8</b> |
| <b>9.</b> | a) | Compare static and electromagnetic Relay.  | <b>8</b> |
|           | b) | Discuss how amplitude comparator can be converted to phase comparator & vice versa.                      | <b>8</b> |

**OR**

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|------------|----|---|----------|
| <b>10.</b> | a) | What do you mean by comparator? Explain integrated type phase comparator. | <b>8</b> |
|            | b) | Explain with a neat sketch microprocessor based Impedance Relay.          | <b>8</b> |

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