B.E. Eighth Semester (Electrical Engineering (Electronics & Power) / Power Engineering) (C.B.S.)

Switch Gear & Protection

P. Pages : 3 **KNT/KW/16/7579/7640**

Time : Three Hours * 0 3 3 8 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.

1. a) Give the classification of protective schemes. Explain them in brief. **8**

b) Why backup protection is necessary? Compare backup protection and primary protection from operation and setting point of view with the help of suitable example. **5**

OR

2. a) Describe the desirable properties of good protective relaying in detail. **8**

b) What do you mean by reach of the relay? Explain overreaching and under reaching of the relay with suitable example. **5**

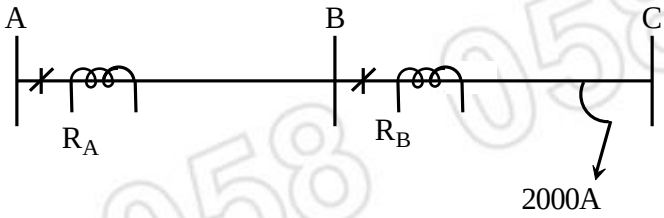
3. a) A 10 amp IDMT relay has a current setting of 150 percent and has time multiplier setting of 0.5. The relay is connected in a circuit through a current transformer having ratio of 500:5 amp. Calculate the time of operation of the relay if the circuit carries a fault current of 6000 amp. The relay characteristic for TSM = 1 is as under – **7**

PSM	2	3.6	5	10	15	20
Time (Sec)	10	6	3.9	2.8	2.2	2.1

b) Discuss the suitable scheme of protection for ring mains with 4 sections. Give the selection of relays with justification. **6**

OR

4. a) For the system shown below, fault current is 2000A, CT ratio for each relay is 200/1. Relay 'B' is set at 100% and relay 'A' is set at 125% for discrimination the time grading of 0.5 sec is provided. **7**



Determine the time of operation of both the relays and TSM of relay 'R_A'
Assuming that relay R_B has TSM = 0.2. At TSM = 1, both the relay have following characteristics.

PSM	2	4	5	8	10	20
Time (Sec)	10	5	4	3.2	2.8	2.4

b) Derive the torque equation of directional unit of directional overcurrent relay. Draw the characteristic of unit showing operating and non-operating region. **6**

5. a) Draw impedance, reactance and mho relay characteristic to protect 100% length of the line having impedance of (2.5 + j6) ohm's per phase. A fault may occure at any length of the line with arc resistance of 2 ohms. Determine the percentage of the line protected by each type of the relay. **7**

b) Explain 3 stepped distance protection scheme using 2 units of reactance relay and 1 unit of mho relay with the help of suitable contact diagram. **7**

OR

6. a) Explain carrier current protection of transmission line base on phase comparison. **7**

b) Explain the following carrier aided distance protection schemes: **7**
i) Carrier acceleration scheme
ii) Carrier blocking scheme

7. a) The neutral point of 10 kv alternator is grounded through a resistance of 10 ohms, the relay is set to operate when there is an out of balance current of 1 Amp. The CT have the ratio of 1000/5. **7**
What percentage of winding is protected against earth fault?
What must be the value of earthing resistance to give 90% protection to each phase winding?

b) Draw the differential protection scheme for a bus bar having two generators connected, one incomming line and four outgoing lines. Explain the working during following conditions- **7**
i) Normal condition.
ii) External fault condition.
iii) Internal fault condition.

OR

8. a) Explain the percentage differential protection of 3 phase star / Delta transformer. Show the polarity markings of CT's. How the protection will remain in operative during magnetising inrush current. **8**

b) Suggest suitable protection against different types of faults and abnormal conditions in EHV induction motor. **6**

9. a) Compare static relays with conventional electromechanical relays. **6**

b) Explain with the help of block diagram and appropriate waveforms the implementation of SINE comparator. **7**

OR

10. a) Discuss how an amplitude comparator can be converted into phase comparator and vice versa. **6**

b) Show that a mho relay characteristic can be obtained by using phase comparator. **7**

11. a) A 220 kv system, the reactance and capacitance upto the location of C.B. is 8Ω and 0.025 μF respectively. A resistance of 600Ω is connected across the C.B. Determine- **8**

i) Natural frequency of oscillation.
ii) Damped frequency of oscillation.
iii) Critical value of resistance which will give no transient oscillation.
iv) The value of resistance which will give damped frequency of oscillation, one fourth of natural frequency of oscillation.

b) Explain in brief recovery rate and energy balance theory applicable to current zero interruption. **5**

OR

12. Write short notes on.

i) SF_6 circuit breaker. **6**

ii) Air blast circuit breaker. **7**

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