Assignment 9

You can submit this assignment by the deadline.

Due on 2023-11-18, 23:59 IST.

1. A max differential relay uses percentage bias characteristics in the current ratio plane. Determine the ratio and series of the circle characteristic for a bias setting of 0.2.

(A) R = 1.25, S = 0.5
(B) R = 1.5, S = 0.5
(C) R = 0.5, S = 0.25
(D) R = 0.75, S = 0.25

No. of answers is correct: 1
Accepted answers: A

2. Find the appropriate region in Fig. 2, where a current ratio plane based line differential relay protecting a radial feeder (as shown in Fig. 1) will find its operating point for an internal fault. Do not consider CT saturation and synchronization errors.

\( I_b = I_a + I_b \), where \( I_a \) and \( I_b \) are the local and remote current phasors.

![Fig 1](image1)

![Fig 2](image2)

(A) (A)
(B) (B)
(C) (C)
(D) (D)

No. of answers is correct: 1
Accepted answers: A

3. Line MN of a 220 kV, 50 Hz system, shown in Fig. 1, is protected by a synchro-based line differential relay with no operating characteristics as shown in Fig. 2. Determine the minimum value of B for dependable operation in a highly loaded condition, considering minimum rated 0.9 and to be 40% of the minimum current.

![Fig 1](image3)

![Fig 2](image4)

(A) 0.5
(B) 1.5
(C) 2.5
(D) 3.5

No. of answers is correct: 1
Accepted answers: B

4. In a 220 kV, 50 Hz transmission network, a line is protected by synchro-based line differential relay, as shown in the fig. The relay is set with \( I_b = 6 \) and \( I_a = 120 \). What will be the decision taken by the relay for 3 different fault cases, as mentioned in Table 1? Consider the system to be homogeneous and other constraints to be ideal except the conditions mentioned in the table for individual case.

![Fig 3](image5)

<table>
<thead>
<tr>
<th>Case</th>
<th>Internal fault</th>
<th>External fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case I</td>
<td>Current fault at local end and with a magnitude of 25% of the rated current.</td>
<td>Current fault at remote end and with a magnitude of 15% of the rated current.</td>
</tr>
<tr>
<td>Case II</td>
<td>Current fault at local end and with a magnitude of 25% of the rated current.</td>
<td>Current fault at remote end and with a magnitude of 15% of the rated current.</td>
</tr>
<tr>
<td>Case III</td>
<td>Current fault at remote end and with a delay of 3.5 ms.</td>
<td>Internal fault</td>
</tr>
</tbody>
</table>

(A) (Case I) No Trip, (Case II) Trip, (Case III) Trip
(B) (Case I) No Trip, (Case II) Trip, (Case III) No Trip
(C) (Case I) Trip, (Case II) Trip, (Case III) No Trip
(D) (Case I) No Trip, (Case II) Trip, (Case III) Trip

No. of answers is correct: 1
Accepted answers: B

5. Plane k currents of all three feeders monitored by a differential relay protecting busbar 7 are provided in Table 2. For the fault cases, with corresponding fault currents. The first test is a phase-to-ground fault and second one is phase-to-phase fault case. Identify both the fault cases based on the relay decisions – internal or external to busbar 7. Policy current of the differential relay to be set as 110% of the maximum feeder current and bias setting to be 50%.

![Fig 4](image6)

<table>
<thead>
<tr>
<th>Case</th>
<th>During Period</th>
<th>During Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case I</td>
<td>0.8 + 0.75 A</td>
<td>0.8 + 0.75 A</td>
</tr>
<tr>
<td>Case II</td>
<td>0.8 + 0.75 A</td>
<td>0.8 + 0.75 A</td>
</tr>
</tbody>
</table>

No. of answers is correct: 1
Accepted answers: B