SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE605 PROTECTION AND SWITCHGEAR

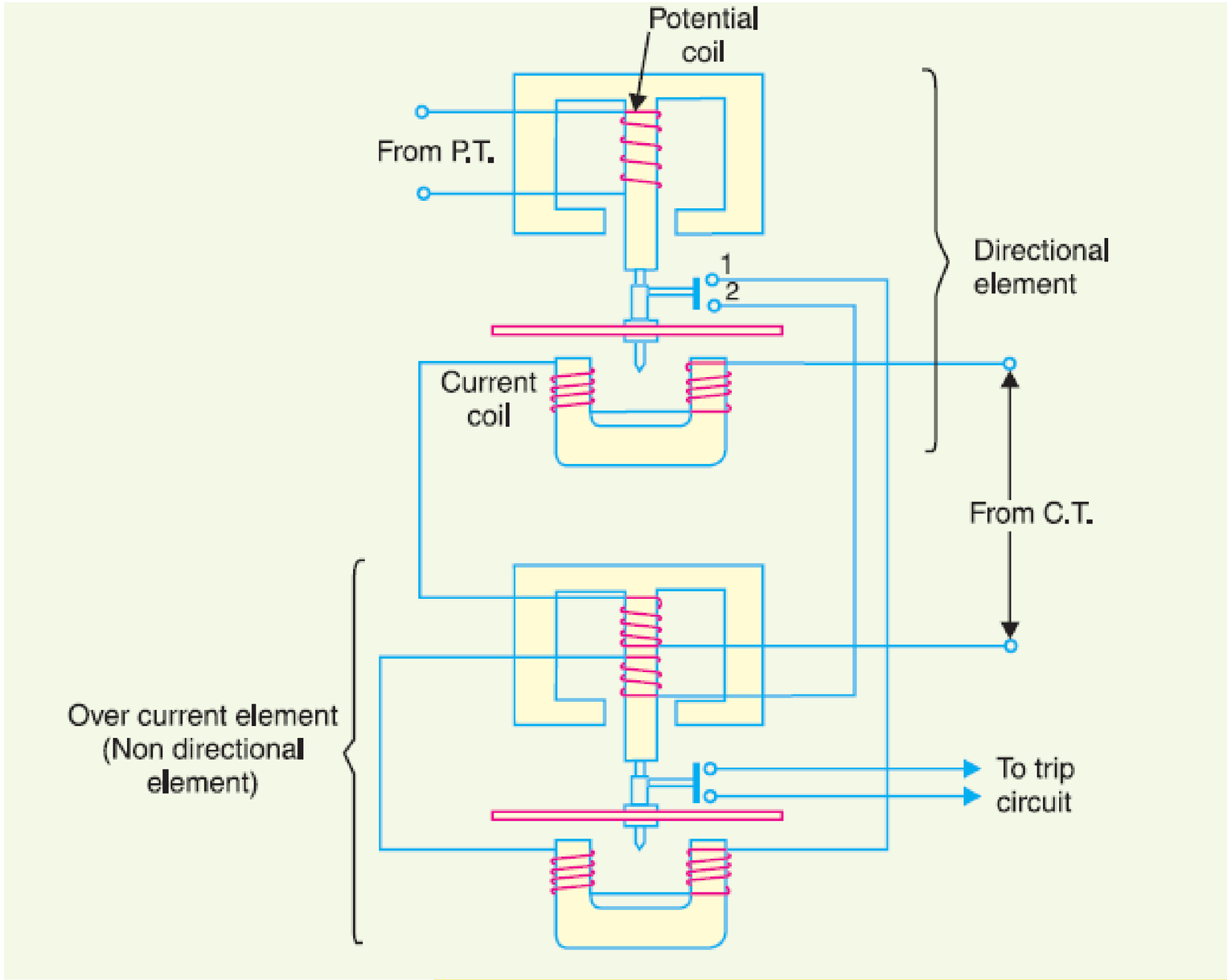
III YEAR /VI SEMESTER

Unit 2- ELECTROMAGNETIC RELAY

Topic: Induction Type Directional Overcurrent Relay

Induction Type Directional Overcurrent Relay

- The directional power relay discussed above is unsuitable for use as a directional protective relay under short-circuit conditions.
- When a short-circuit occurs, the system voltage falls to a low value and there may be insufficient torque developed in the relay to cause its operation.
- This difficulty is overcome in the directional overcurrent relay which is designed to be almost independent of system voltage and power factor.


Potential coil
From P.T.
1
2
Directional element
Current coil
From C.T.
Over current element (Non directional element)
To trip circuit

Constructional details.

- It consists of two relay elements mounted on a common case *viz.* (*i*) directional element and (*ii*) non-directional element.

(*i*) *Directional element.*

- It is essentially a directional power relay which operates when power flows in a specific direction.
- The potential coil of this element is connected through a potential transformer (P.T.) to the system voltage.
- The current coil of the element is energised through a C.T. by the circuit current.
- This winding is carried over the upper magnet of the non-directional element.
- The trip contacts (1 and 2) of the directional element are connected in series with the secondary circuit of the overcurrent element.
- Therefore, the latter element cannot start to operate until its secondary circuit is completed.
- In other words, the directional element must operate first (*i.e.* contacts 1 and 2 should close) in order to operate the overcurrent element.

(*ii*) *Non-directional element.*

- It is an overcurrent element similar in all respects to a non-directional overcurrent relay.
- The spindle of the disc of this element carries a moving contact which closes the fixed contacts (trip circuit contacts) after the operation of directional element.
- It may be noted that plug-setting bridge is also provided in the relay for current setting but has been omitted in the figure for clarity and simplicity.
- The tappings are provided on the upper magnet of overcurrent element and are connected to the bridge.

Operation.

- Under normal operating conditions, power flows in the normal direction in the circuit protected by the relay.
- Therefore, directional power relay (upper element) does not operate, thereby keeping the overcurrent element (lower element) unenergised.
- However, when a short-circuit occurs, there is a tendency for the current or power to flow in the reverse direction.
- Should this happen, the disc of the upper element rotates to bridge the fixed contacts 1 and 2.
- This completes the circuit for overcurrent element.
- The disc of this element rotates and the moving contact attached to it closes the trip circuit.
- This operates the circuit breaker which isolates the faulty section.
- The two relay elements are so arranged that final tripping of the current controlled by them is not made till the following conditions are satisfied :

  (*i*) current flows in a direction such as to operate the directional element.

  (*ii*) current in the reverse direction exceeds the pre-set value.

  (*iii*) excessive current persists for a period corresponding to the time setting of overcurrent element.

Assessment

Directional relays distinguish between:

A. Fault current and load current

B. AC and DC currents

C. Single-phase and three-phase faults

D. Forward and reverse power flow.

References

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3. Badriram, Vishwakarma B.H, “Power System Protection and Switchgear”, New Age International Pvt Ltd Publishers, 2nd Edition 2017.

Thank You