



# **SNS COLLEGE OF ENGINEERING**

Kurumbapalayam (Po), Coimbatore – 641 107

**An Autonomous Institution**

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



## **DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**COURSE NAME : 19EE605 PROTECTION AND SWITCHGEAR**

III YEAR /VI SEMESTER

Unit 2- ELECTROMAGNETIC RELAY

Topic: Differential Relays



- Most of the relays discussed so far relied on excess of current for their operation.
- Such relays are less sensitive because they cannot make correct distinction between heavy load conditions and minor fault conditions.
- In order to overcome this difficulty, differential relays are used.



- A **differential relay** is one that operates when the phasor difference of two or more similar electrical quantities exceeds a pre-determined value.
- Thus a current differential relay is one that compares the current entering a section of the system with the current leaving the section.
- Under normal operating conditions, the two currents are equal but as soon as a fault occurs, this condition no longer applies.
- The difference between the incoming and outgoing currents is arranged to flow through the operating coil of the relay.
- If this differential current is equal to or greater than the pickup value, the relay will operate and open the circuit breaker to isolate the faulty section.

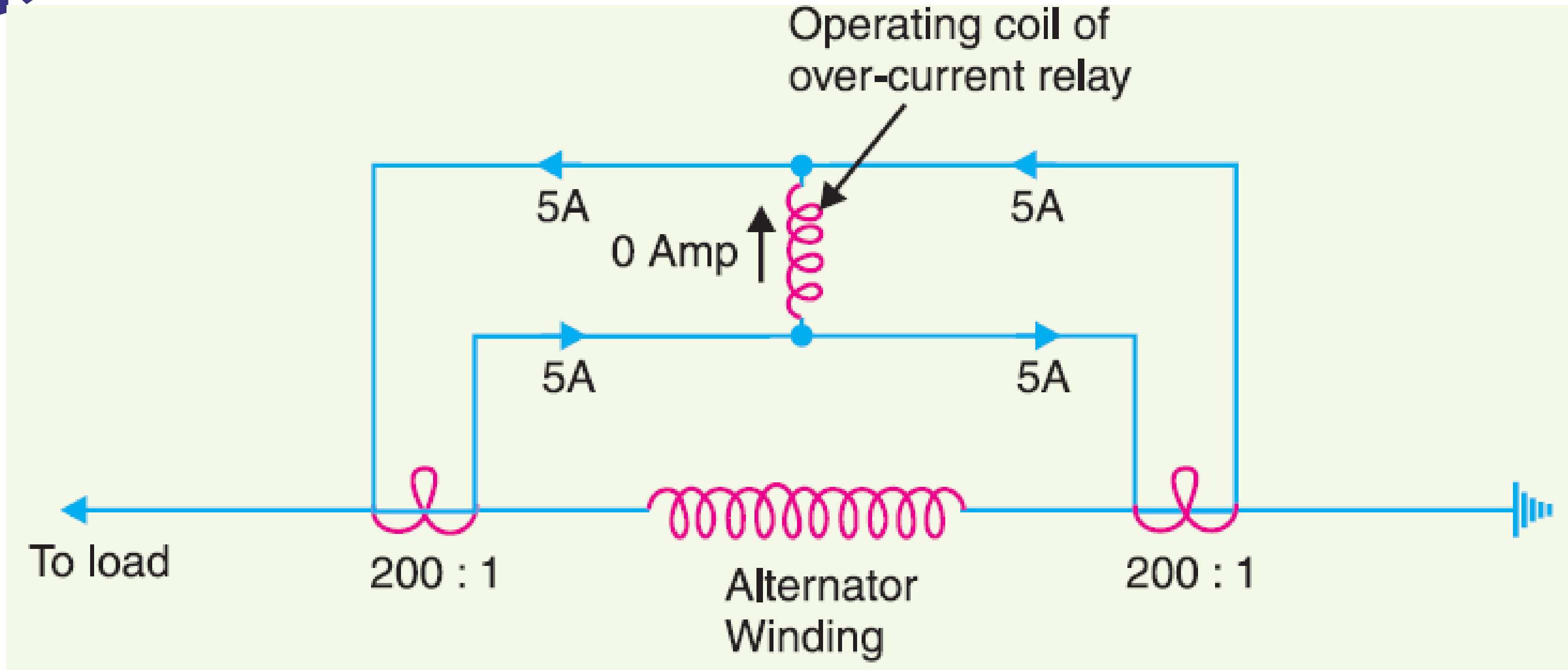


There are two fundamental systems of differential or balanced protection *viz.*

**(i)** Current balance protection

**(ii)** Voltage balance protection

# Current Differential Relay



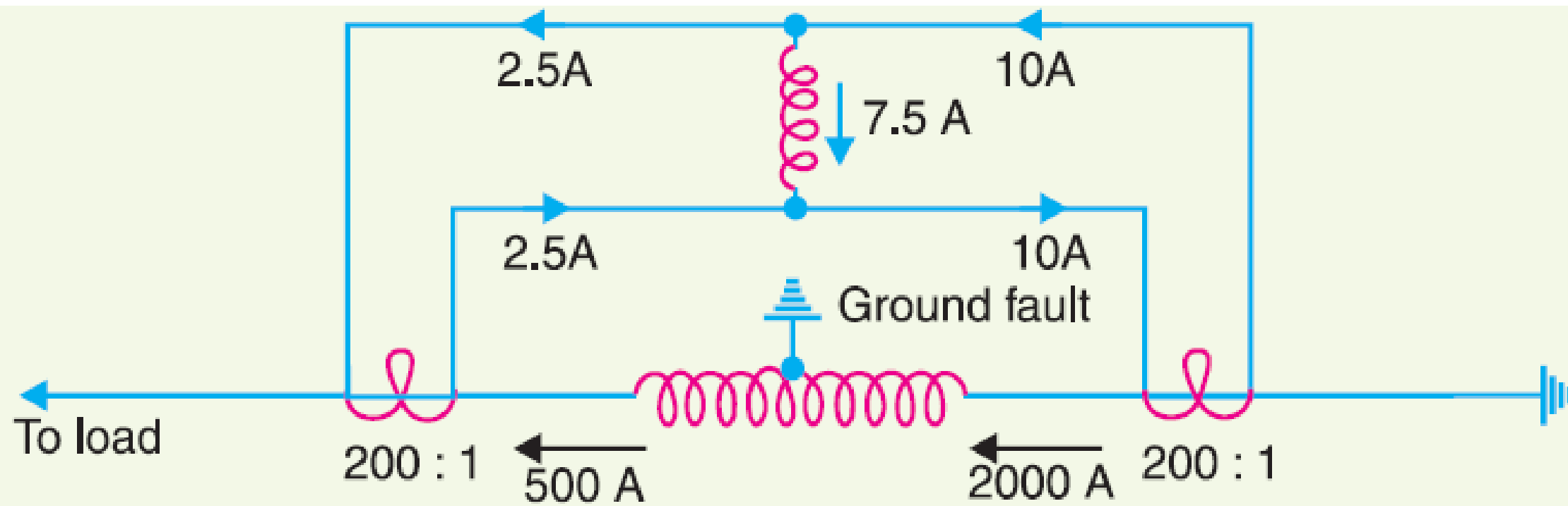


- A pair of identical current transformers are fitted on either end of the section to be protected (alternator winding in this case).
- The secondaries of CT's are connected in series in such a way that they carry the induced currents in the same direction.
- The operating coil of the overcurrent relay is connected across the CT secondary circuit.
- This differential relay compares the current at the two ends of the alternator winding.

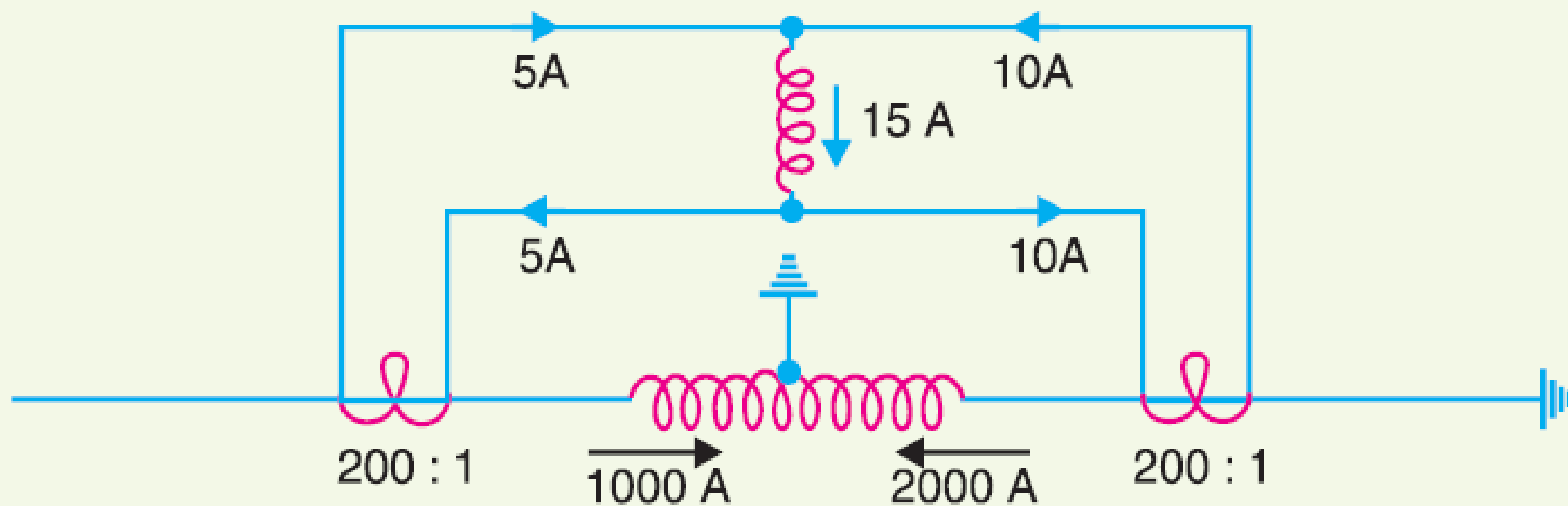




- Under normal operating conditions, suppose the alternator winding carries a normal current of 1000 A.
- Then the currents in the two secondaries of CT's are equal.
- These currents will merely circulate between the two CT's and no current will flow through the differential relay.
- Therefore, the relay remains inoperative.
- If a ground fault occurs on the alternator winding the two secondary currents will not be equal and the current flows through the operating coil of the relay, causing the relay to operate.
- The amount of current flow through the relay will depend upon the way the fault is being fed.



(i)



(ii)





# Assessment



A differential relay response to

- A. Algebraic difference of two or more similar electrical quantities
- B. Phasor difference of two or more similar electrical quantities.
- C. Algebraic difference between two currents
- D. Algebraic difference between two voltages





# References



1. SuniS Rao, “Switchgear, Protection and Power System (Theory, Practice & Solved Problems)”, Khanna Publishers, New Delhi, 2019.
2. Paithankar Y G, Bhide S R, “Fundamentals of Power System Protection”, Prentice Hall of India Pvt Ltd., New Delhi, 2<sup>nd</sup> Edition, 2014.
3. Badriram, Vishwakarma B.H, “Power System Protection and Switchgear”, New Age International Pvt Ltd Publishers, 2<sup>nd</sup> Edition 2017.

**Thank You**