



# **SNS COLLEGE OF ENGINEERING**

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

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

III YEAR /VI SEMESTER

Unit 3- APPARATUS PROTECTION

Topic: Protection of Transformers



# Introduction

- Transformers are static devices, totally enclosed and generally oil immersed.
- Therefore, chances of faults occurring on them are very rare. However, the consequences of even a rare fault may be very serious unless the transformer is quickly disconnected from the system.
- This necessitates to provide adequate automatic protection for transformers against possible faults.



# Introduction



- Small distribution transformers are usually connected to the supply system through series fuses instead of circuit breakers.
- Consequently, no automatic protective relay equipment is required.
- However, the probability of faults on power transformers is undoubtedly more and hence automatic protection is absolutely necessary.



# Common transformer faults



As compared with generators, in which many abnormal conditions may arise, power transformers may suffer only from :

**(i)** open circuits

**(ii)** overheating

**(iii)** winding short-circuits *e.g.* earth-faults, phase-to-phase faults and inter-turn faults.

- An open circuit in one phase of a 3-phase transformer may cause undesirable heating.
- In practice, relay protection is not provided against open circuits because this condition is relatively harmless.
- On the occurrence of such a fault, the transformer can be disconnected manually from the system.



- Overheating of the transformer is usually caused by sustained overloads or short-circuits and very occasionally by the failure of the cooling system.
- The relay protection is also not provided against this contingency and thermal accessories are generally used to sound an alarm or control the banks of fans.
- Winding short-circuits (also called *internal faults*) on the transformer arise from deterioration of winding insulation due to overheating or mechanical injury.
- When an internal fault occurs, the transformer must be disconnected quickly from the system because a prolonged arc in the transformer may cause oil fire.
- Therefore, relay protection is absolutely necessary for internal faults.



# Protection Systems for Transformers



The principal relays and systems used for transformer protection are :

**(i)** *Buchholz devices* providing protection against all kinds of incipient faults *i.e.* slow-developing faults such as insulation failure of windings, core heating, fall of oil level due to leaky joints etc.

**(ii)** *Earth-fault relays* providing protection against earth-faults only.

**(iii)** *Overcurrent relays* providing protection mainly against phase-to-phase faults and overloading.

**(iv)** *Differential system* (or circulating-current system) providing protection against both earth and phase faults.





# Assessment



Any transformer needs to be protected from \_\_\_\_\_

- a) transformer faults
- b) faults occurring on the transformer connected system
- c) faults within and on system.
- d) other faults





# References



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

**Thank You**