Lecture 13

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EE114 - Power Engineering 1

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Efficiency :-

$$\eta = \frac{P_{out}}{P_{out} + P_{loss}}$$

Voltage regulation :-

$$\text{Voltage regulation} = \frac{|V_{0-NL}| - |V_{0-fL}|}{|V_{0-fL}|}$$

The change in voltage when the load is removed. Ideally we would want to have the voltage regulation to be zero. But practically, the voltage of the transformer at no load is going to be slightly higher than the case when full load is connected to the transformer.

How to test the transformer before deploying it to the field?

We do not load a transformer upto full ratings because there may not be a fictitious load of such a high rating available for testing.

We perform some tests to find equivalent ckt parameters and then calculate the efficiency and regulation.

The tests are called ① open-ckt tests
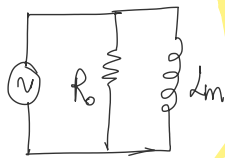② short-ckt tests

Open ckt test

Performed on low voltage side as low voltage supply may easily be available for testing

Performed on LV side

At nominal voltage

At very very low current
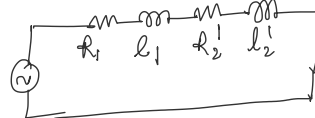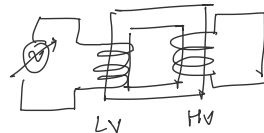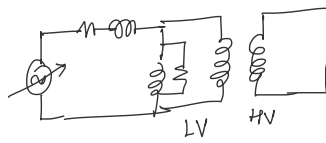
Equivalent ckt :-

Lm
Ro
Referred to LV side

R₁ & L₁ are neglected

Short ckt test

It is performed at rated current by connecting a very low voltage at high voltage side.

Performed on HV side
HV side is shorted

At rated current

At very very low voltage

LV   HV

LV   HV

R_1 l_1 R_2^1 l_2^1

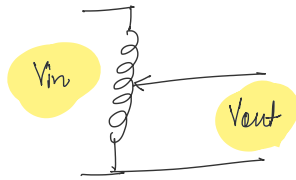The branch Ro & Lm are neglected
① Voltage applied is very small
② The small magnetizing current becomes further reduced
Can easily be ignored.

** Once we have the equivalent circuit we can then calculate the efficiency & voltage regulation. **

* Autotransformer :-

In case we don't want isolation and only want the voltage gain

We use only a single coil.

Ques 4. Assignment 3a.

Case 1.

$P_{hys} + P_{eddy} = 3 \, kW \quad @ \quad 50 \, Hz$

$\quad \alpha \qquad \alpha$

$\quad f \qquad f^2$

$= a f B_m^{1.6} = b f^2 B_m^2$