SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19ECT201 ELECTRICAL ENGINEERING INSTRUMENTATION

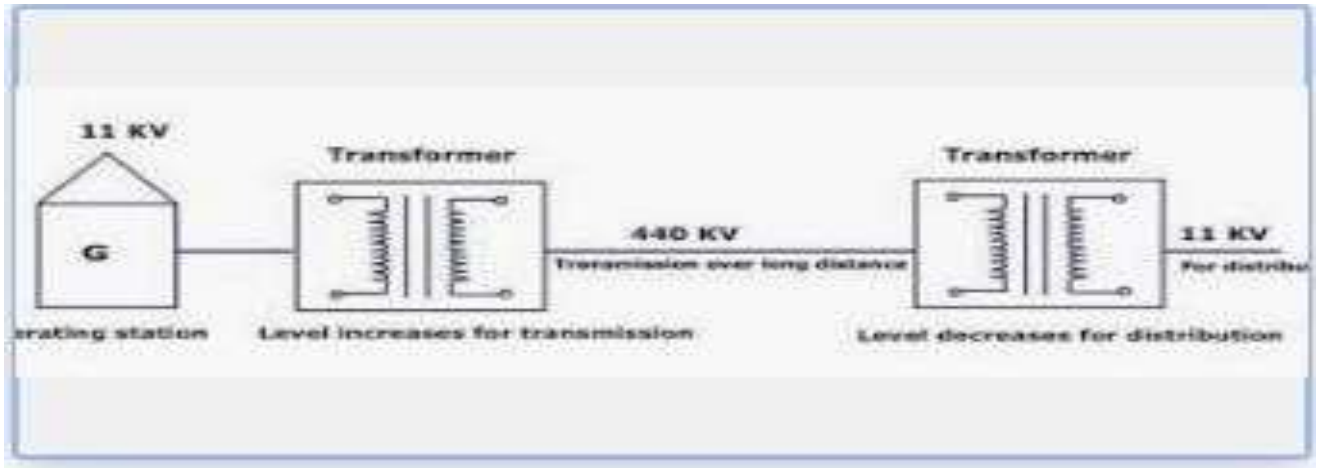
II YEAR /III SEMESTER ECE

Unit 2-Transformer

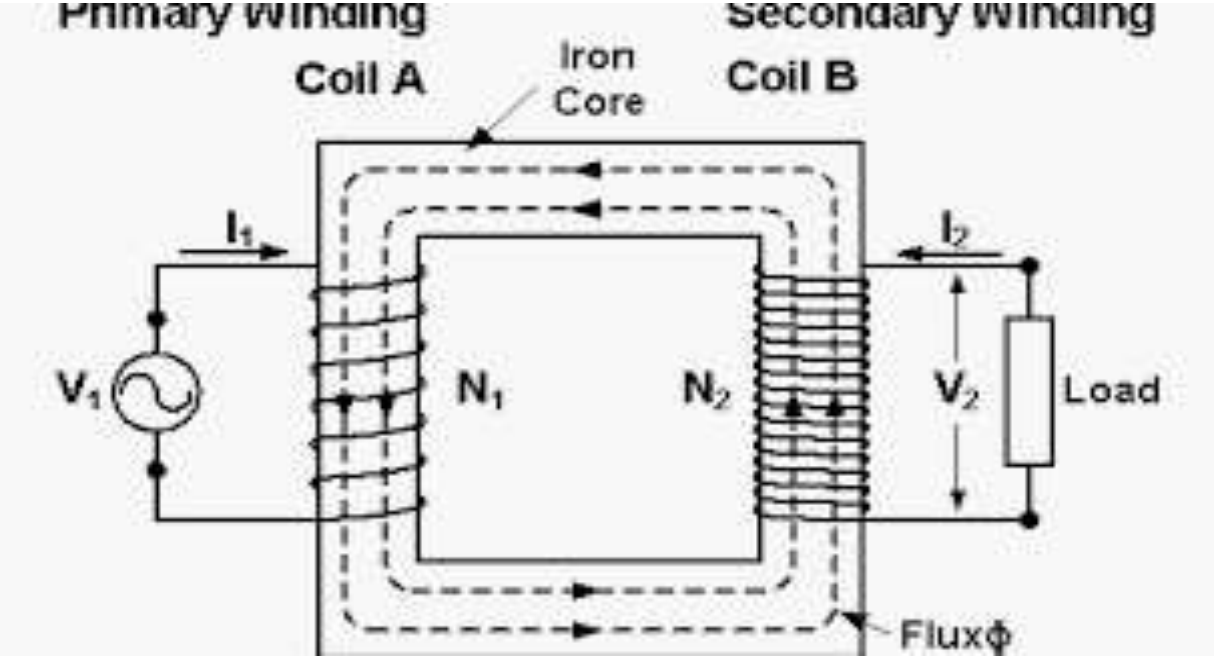
Transformer-construction,principle,types

TRANSFORMER

Electrical transformer is a static electrical machine which transforms electrical power from one circuit to another circuit, without changing the frequency. Transformer can increase or decrease the voltage with corresponding decrease or increase in current.

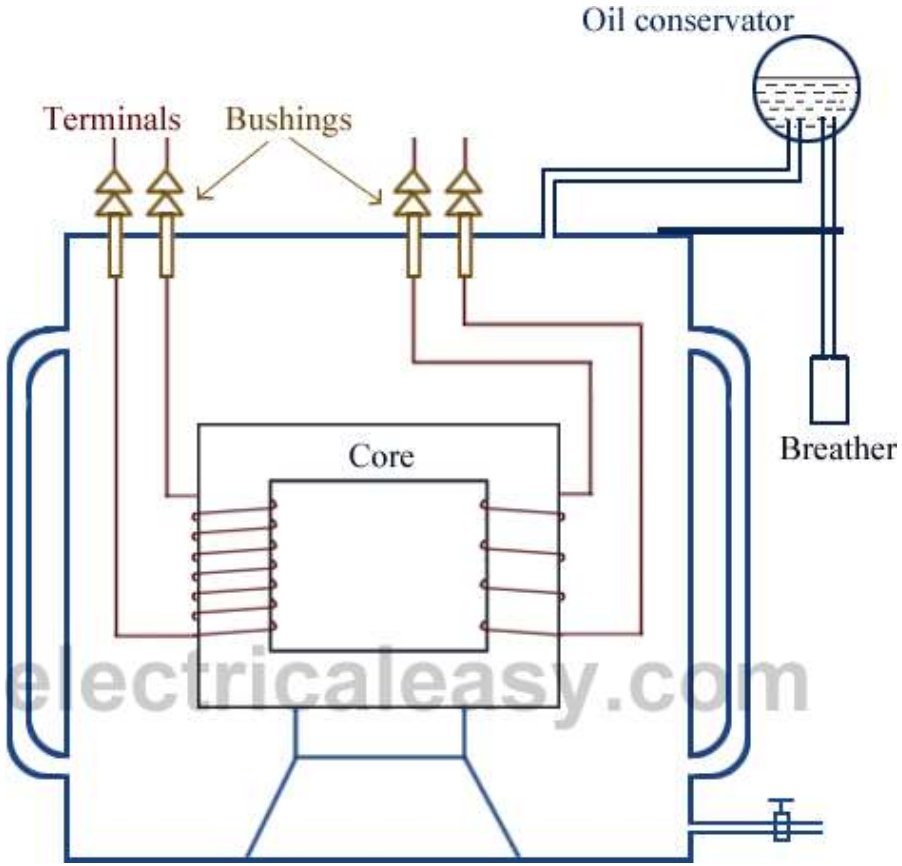


Working Principle Of Transformer



- The basic principle behind working of a transformer **when two coils are inductively coupled and if current in one coil is changed uniformly then e.m.f get induced in other coil**
- Basically a transformer consists of two inductive coils; primary winding and secondary winding. The coils are electrically separated but magnetically linked to each other.
- When, primary winding is connected to a source of alternating voltage(has N1 number of turns)
- secondary winding is connected to load(has N2 number of turns)
- when primary winding is excited by alternating voltage it circulates an alternating current.
- This produces an alternating flux which links with secondary winding
- As flux is alternating according to Faraday's law of electromagnetic induction mutually induced e.m.f gets developed in secondary winding
- D.C supply cannot be used for transformers
- As transformers works on principle of mutual induction ,for which current in one coil must change uniformly.
- If D.C supply is given current will not change due to constant supply and transformer will not work.

construction



Various parts of transformer

1. CORE

Made up of high grade silicon steel lamination Used to carry flux produced by winding

2. Limb

Vertical portion of core

Carry windings

3. Yoke

Top and bottom horizontal portion of core

Used to carry flux in one winding to other winding

4. Windings

Coils used are wound on limbs and insulated from one another Used to carry current and produce necessary flux for functioning of transformer

5. Conservator

Oil in transformer expands when temperature inside transformer increases due to heat and contracts when temperature decreases Function of conservator is to take up the expansion and contraction of oil

6. Breather

Smaller transformers are not fully filled with oil there will be small space between oil level and tank

Tank is connected to atmosphere by vent pipe

When oil expands air will go out and when oil contracts air is taken in. Function :

It is a device extracts moisture from air when air is taken in and does not allow oil to come in contact with moisture

It contains silica gel to absorb moisture

7. Explosion vent

It is a bent pipe fitted on main tank It act as a relief valve

It uses non metallic diaphragm which bursts when pressure inside transformer becomes excessive ,it relaeases pressure and protects transformer

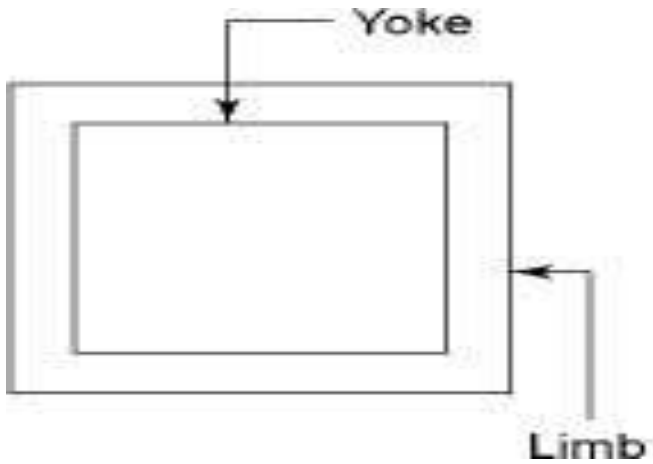
8. Buchholz relay

It is a safety gas operated relay connected to transformer When faults gets developed inside transformer gases released Buchholz relay operated with these gases and trips circuits breaker to protect device

2 basic parts of transformer 1.Magnetic core

2. Winding or coils 1.Magnetic core

Square or rectangle in size



It is further divided in to

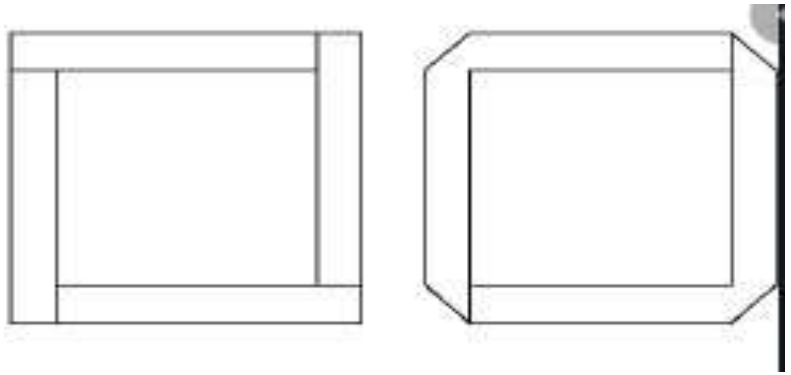
LIMB Vertical portion on which coils are wound

YOKE top and bottom horizontal portion

Core is made up of laminations to minimize eddy current losses

Laminations are overlapped to avoid air gaps at joint generally I shaped and L shaped laminations

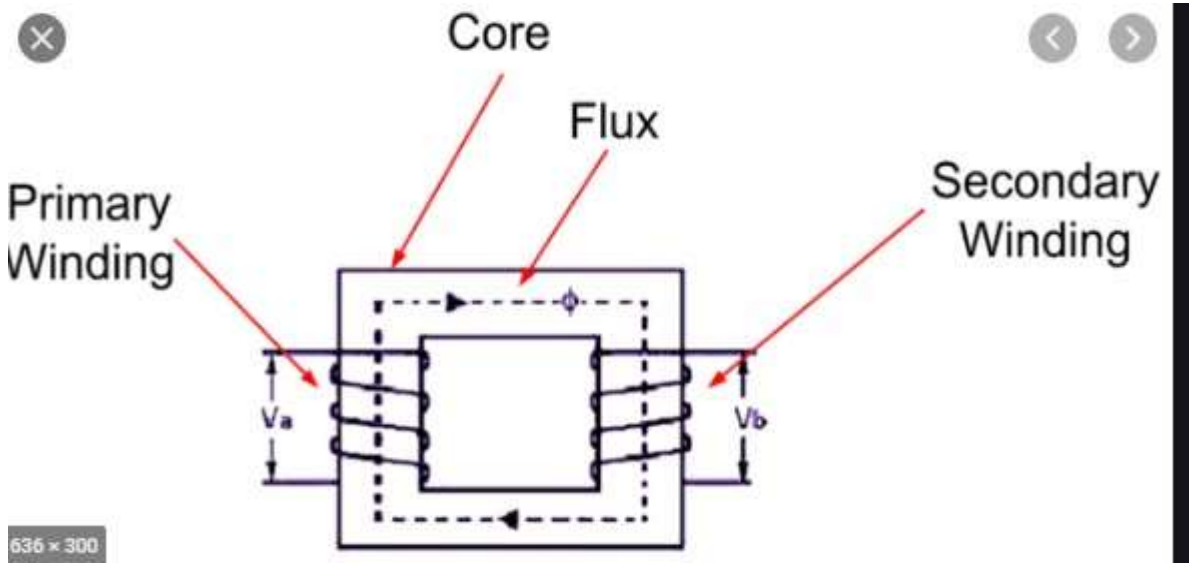
I shaped and L shaped



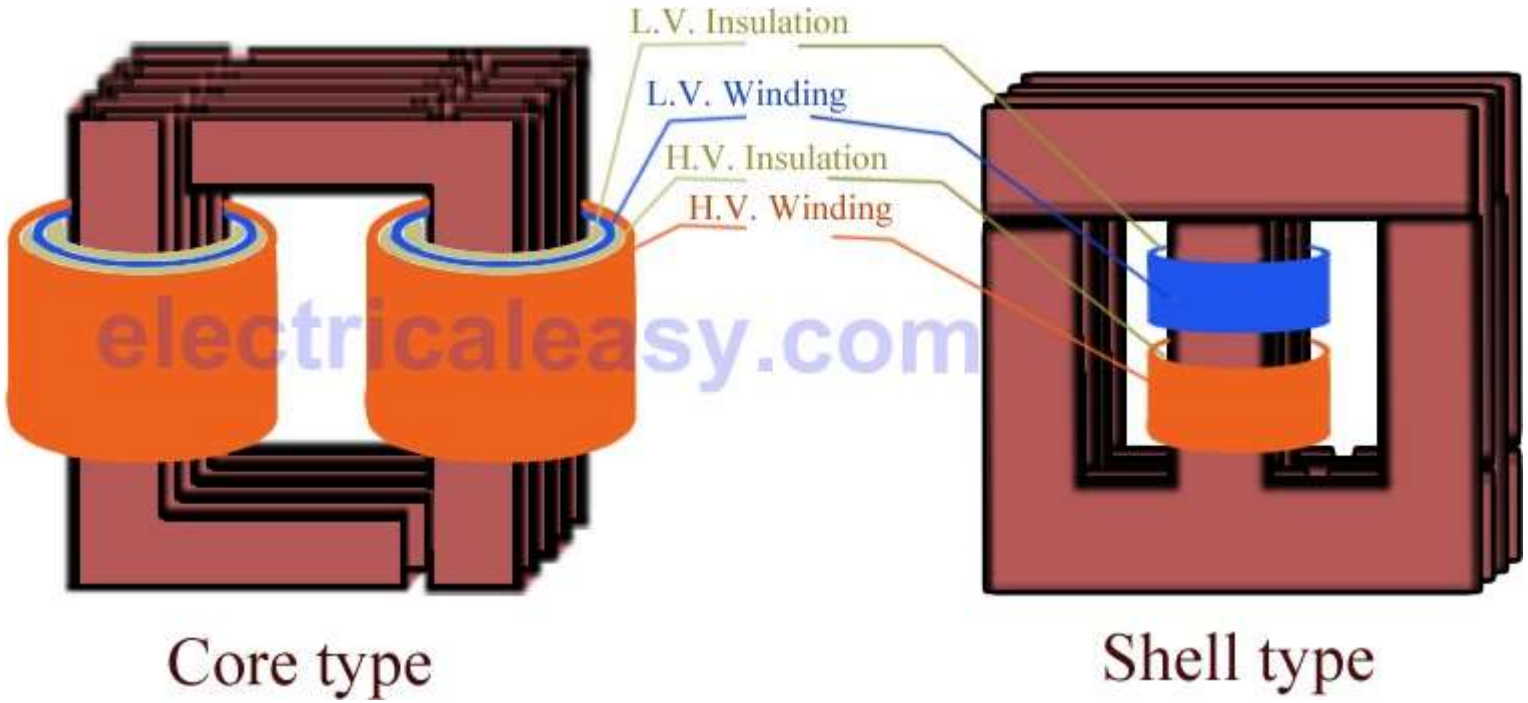
Types

1. Core type
2. shell type

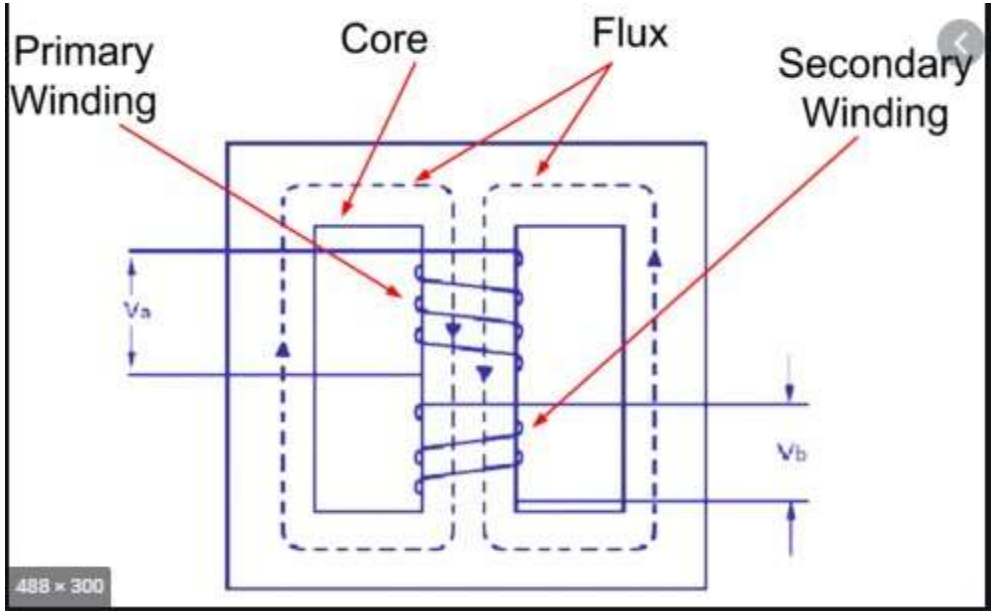
Core type transformer



- Core is rectangular having 2 limbs
- core is made up of large number of thin laminations
- windings are uniformly distributed over core
- coils are cylindrical in type wound in helical layer with different layers insulated from each other by paper or mica
- coils are placed on both limbs



Shell type



Both windings are placed on central limb

Core encircles windings

Core is laminated

For very high voltage

Transformations shell type is preferred

Winding is surrounded by core so natural cooling does not exits

Comparison of core and shell

Sr. No.	Core Type	Shell Type
1.	The winding encircles the core.	The core encircles most part of the windings.
2.	The cylindrical type of coils are used.	Generally, multilayer disc type or sandwich coils are used.
3.	As windings are distributed, the natural cooling is more effective.	As windings are surrounded by the core, the natural cooling does not exist.
4.	The coils can be easily removed from maintenance point of view.	For removing any winding for the maintenance, large number of laminations are required to be removed. This is difficult.
5.	The construction is preferred for low voltage transformers.	The construction is used for very high voltage transformers.
6.	It has a single magnetic circuit.	It has a double magnetic circuit.
7.	In a single phase type, the core has two limbs.	In a single phase type, the core has three limbs.

A transformer has **500** primary turns and **3000** secondary turns. If the primary voltage is **240 V** determine the Secondary voltage, assuming an ideal transformer

For an ideal transformer, voltage ratio = turns ratio, i.e.

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}, hence\ \frac{240}{V_2} = \frac{500}{3000}$$

$$Thus\ secondary\ voltage\ V_2 = \frac{(3000)\ (240)}{(500)} = 1440\ V\ or\ 1.44\ kV$$