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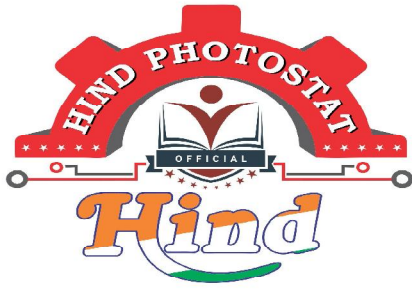
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MADE EASY
ELECTRICAL ENGINEERING
Transformer Machine
By.Murli Sir

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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Definition :

(i) Transformer is a [static device] which transfer AC electrical energy from one circuit to the another through the action of magnetic field.

Key word :

[Transfers AC electric energy] - [Through magnetic field]

circuit is generalised word for coil and winding.

A magnet is surrounded by magnetic field called flux. Flux is a life of a machine whether you take DC M/C, Induction M/C, synchronous M/C, transformer, these all are working on the flux only. So [a machine work because of flux only.]

All the electricity we get is through flux only.

A generator works because of flux & a motor rotates because of flux, a [transformer transfer the power because of flux only.]

(ii) Transformer operate on the [principle of mutual induction]. b/w two are more magnetically coupled coils.

Key word :- Mutual induction principle b/w two are more magnetically coupled circuits (coil/winding)

(iii) It transform AC electrical energy or power at one voltage level to another voltage level [without the change in frequency & power]

Key word : - Transfer Electrical energy at one voltage level to another (at same F & P)

constant power means that the transformer have highest possible η in all electrical machinery/devices. Efficiency is almost 100% or in a well design transformer efficiency is close to 100% i.e; i/p power is equal to o/p power, the losses are very small & they can be neglected.

(iv) Magnetically coupled coils wound on common ferromagnetic core.
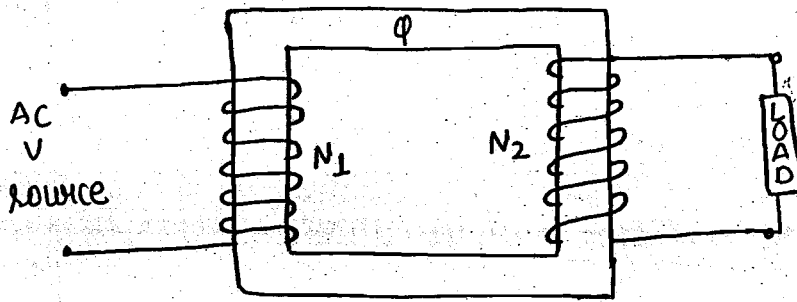
the connection b/w these two coils is due to the common flux. In the common core. i.e; these two coils are magnetically coupled when we connect the AC power source then there will be flux in transformer. then it produce voltage in another side.

→ The [coil] which is [connected] to the [source] is, called [i/p winding or primary winding].

→ the other [winding where] is [load connected] is called [secondary or o/p winding].

→ If transformer having third winding then it is called as tertiary winding.

→ one winding receive the power another one is delivering the power.

10 Aspects of transformer :

(i) [Static device] i.e; No moving or rotating part, every thing is stationary

        Flux : stationary
        conductor : stationary

(ii) [Electromagnetic energy conversion device] (Internally)
i.e; externally no energy conversion is occurs

        I/p is electrical ——→ o/p is electrical

Internally ⇒ Electrical ——→ Magnetic field ——→ Electrical
operation

NOTE-: Transformer is not a electrical machine. It is a device But we take like as a machine only.

Machine is a electromechanical energy device. conversion
i.e; Electrical $\rightleftarrows$ Mechanical

(iii) It is singly excited device i·e; we applied voltage to only one winding of a transformer.

(iv) constant flux device neglecting the transient change in flux.

(v) constant power

(vi) constant frequency

(vii) Magnetically coupled circuits [-ve magnetic coupling in accordance to lenz's law]

(viii) It is automatic control system [with negative feedback]

(ix) It is Phase shifting Device [w.r.t. voltage]

(x) It works only on AC

Classification of transformer :-

1. Based on No. of windings:

If there is 1 winding → Auto T/F

2 windings (primary & secondary)

3 windings (primary & secondary, tertiary)

2. Based on core construction:

ⓐ core type transformer

ⓑ shell type transformer

3. Based on No. of phases:

ⓐ 1-φ T/F

ⓑ 3-φ T/F
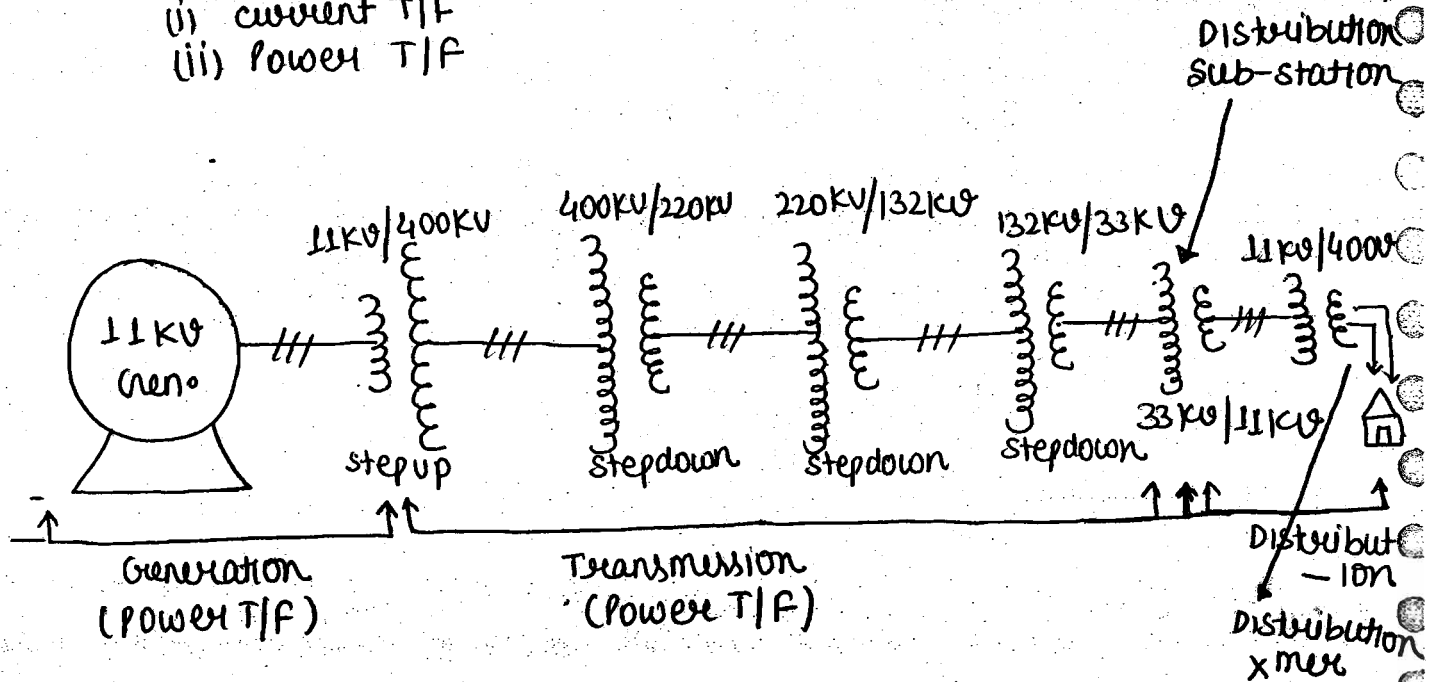
Three 1-φ T/F are internally connected to 3-φ T/F bank.

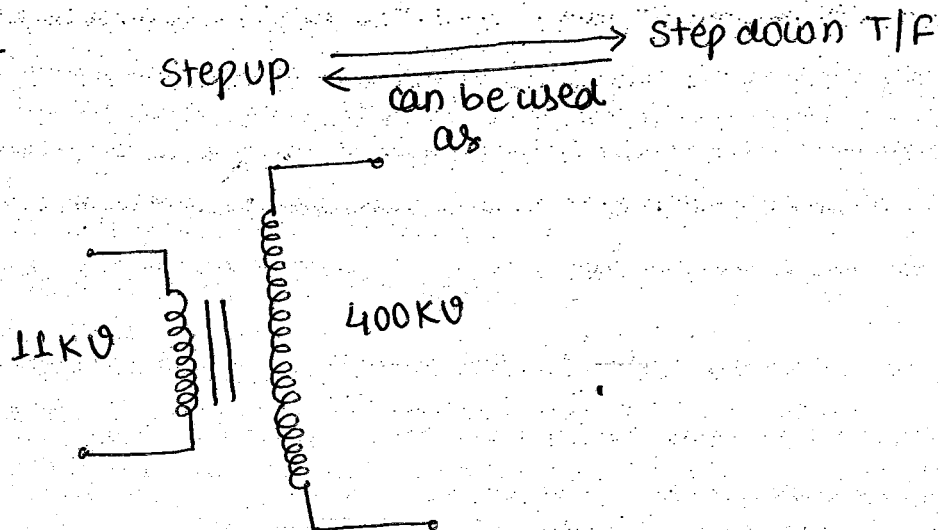4. Based on the operating frequency

ⓐ Power frequency T/F (25-500 Hz)

ⓑ Audio frequency T/F (20Hz to 20kHz)

5. Based on Application : Many Numerous kind of T/F

(*) (a) Power system...   (b) Power electronic
    (i) Power T/F   (i) Pulse T/F
    (ii) Distribution T/F   (ii) Gate pulse triggering

(c) Instrumentation   (d) Electronic & control system
    (i) current T/F
    (ii) Power T/F

Generation (Power T/F)   Transmission (Power T/F)   Distribution Distribution Xmer

NOTE-:

Step up $\xrightarrow{\hspace{3cm}}$ Step down T/F
$\xleftarrow{\text{can be used as}}$

11KV   400KV

Step up mode : 11KV called primary winding.
                400KV called secondary winding.

Step down mode : 11 KV called secondary winding
                  400KV called primary winding.