Transformer

A transformer is an electrical device that changes the potential difference (voltage) of an alternating current supply. There are 2 types of Transformer

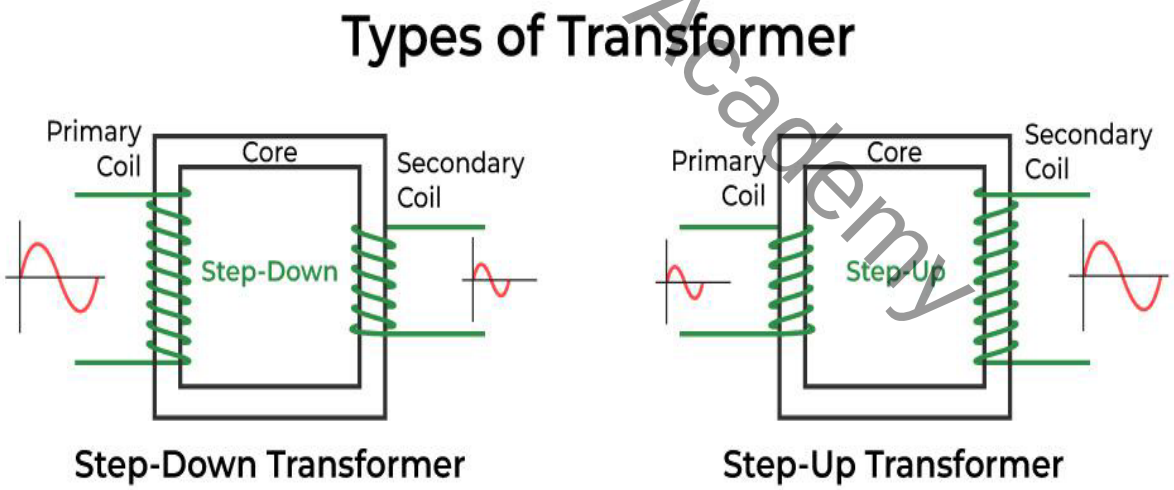
1. Step-up transformers
2. Step-down transformers

1. Step-up Transformers:

Step-up transformers have more turns on the secondary coil than the primary coil and therefore they **increase the potential difference**. A higher p.d means a lower current. This reduces energy loss via heat when the electricity is travelling through wires around the national grid.

2. Step- down Transformer:

Step-down transformers have more turns on the primary coil than the secondary coil and they **decrease the potential difference**. They are used to reduce the voltage to a level that can be used in homes.



How transformer work:

A basic transformer consists of two coils of wire, which are not connected. These coils are wrapped around an iron core.

1. An alternating current is supplied to the primary coil.

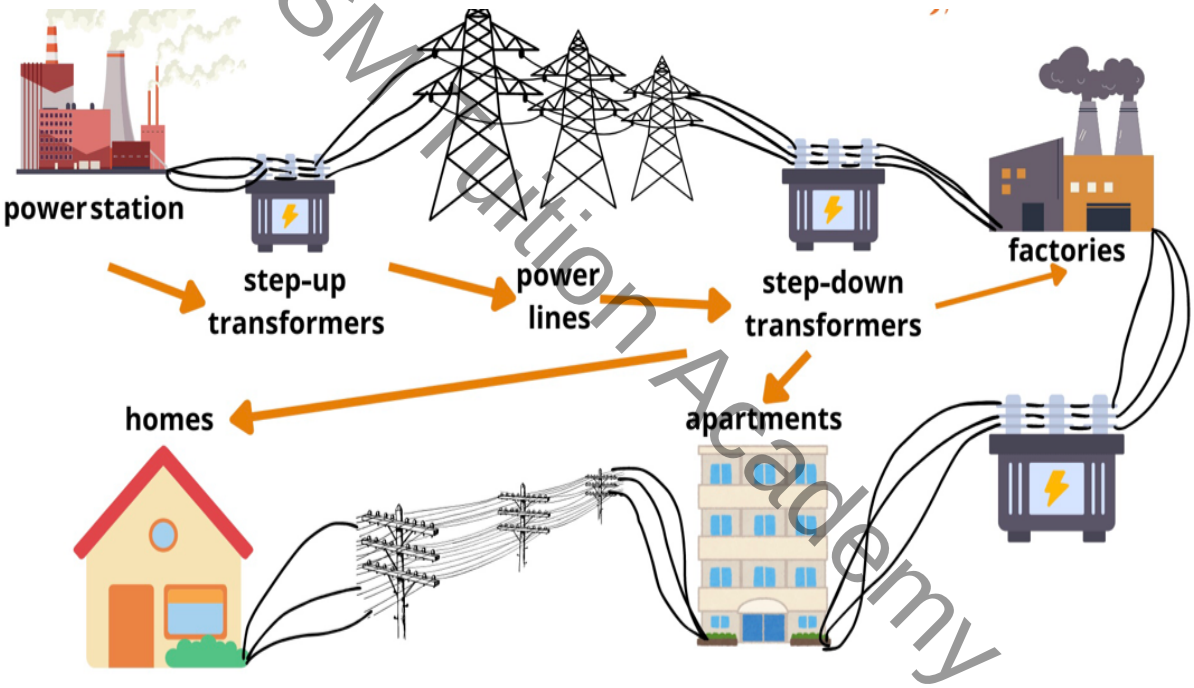
2. The current flows through the primary coil and produces a magnetic field.Since the current keeps changing direction, the magnetic field does as well

3. The iron core is easily magnetised, so the changing magnetic field passes through it.

4. As a result, the changing magnetic field induces a potential difference in the secondary coil. The magnetic field is constantly changing, so the potential difference induced will be alternating.

5. If the secondary coil is part of a complete circuit, then alternating current will flow.

Transformers do not work with direct current (DC) as the magnetic field produced by DC does not change.



The Transformer Equation

The ratio of the **potential differences** across the **primary** and **secondary coils** is dependent on the ratio of the number of turns on each coil. The **transformer equation** allows us to calculate the output potential difference of a transformer as long as we know the number of turns on each coil and the input potential difference:

- Vp : is the **potential difference across the primary coil** in **volts** (V)(*V*)

- Vs: is the **potential difference across the secondary coil** in **volts** (V)(*V*)
- np: is the **number of turns on the primary coil**
- ns: is the **number of turns on the secondary coil**

For **step-up transformers:** Vs>Vp .

For **step-down transformers:** Vs<*Vp* .

Uses of Transformers

Transformers are used:

1. To increase the potential difference (voltage) of an alternating current supply, before it is transmitted across the National Grid.
2. To lower the high voltage of electricity used in power lines to levels suitable for use in homes.