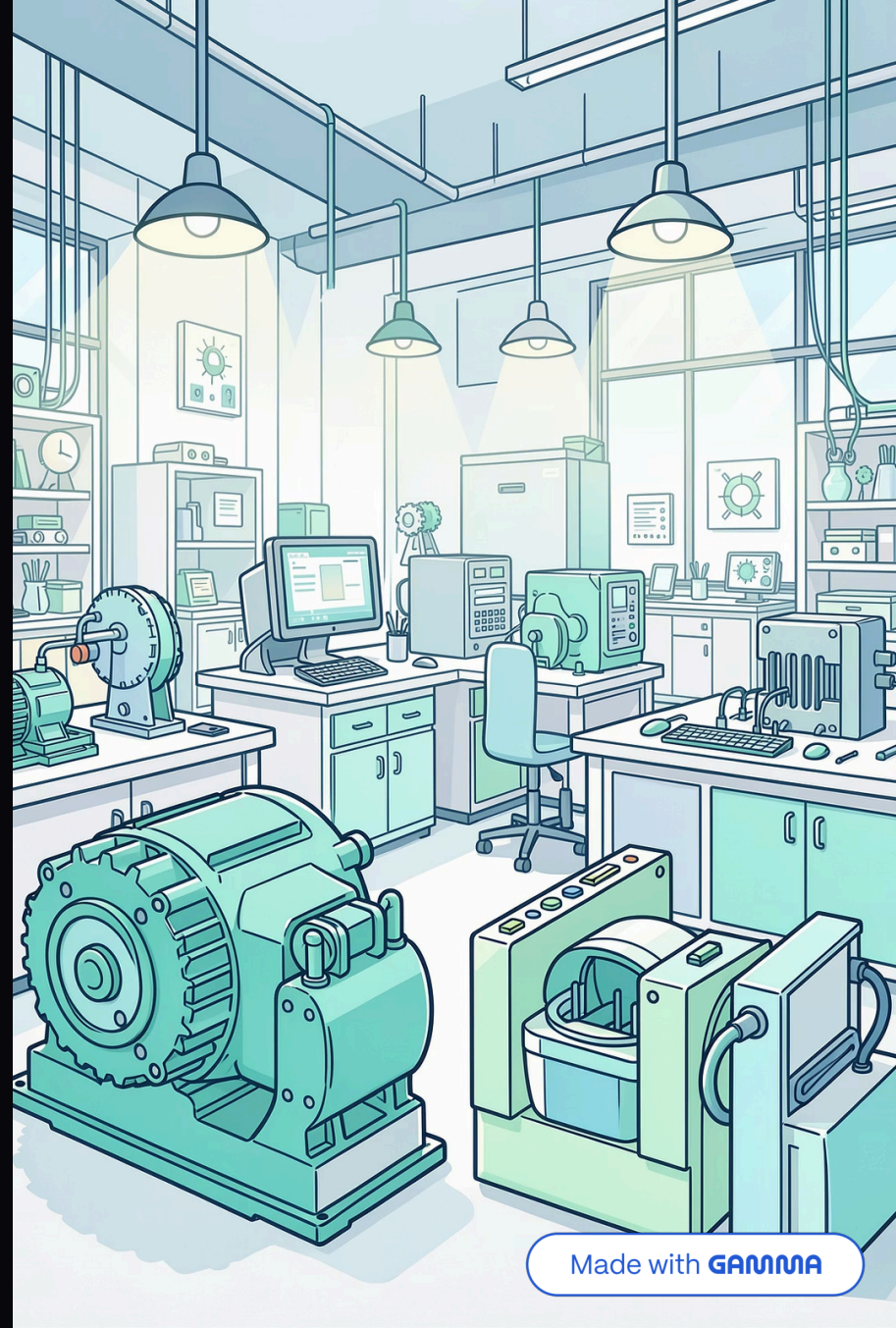
Motors, Transformers and Transducers

Name: Class/Roll No: Subject:



INTRODUCTION

Electrical Machines and Devices

Motors

Convert electrical energy into mechanical energy for movement and rotation.

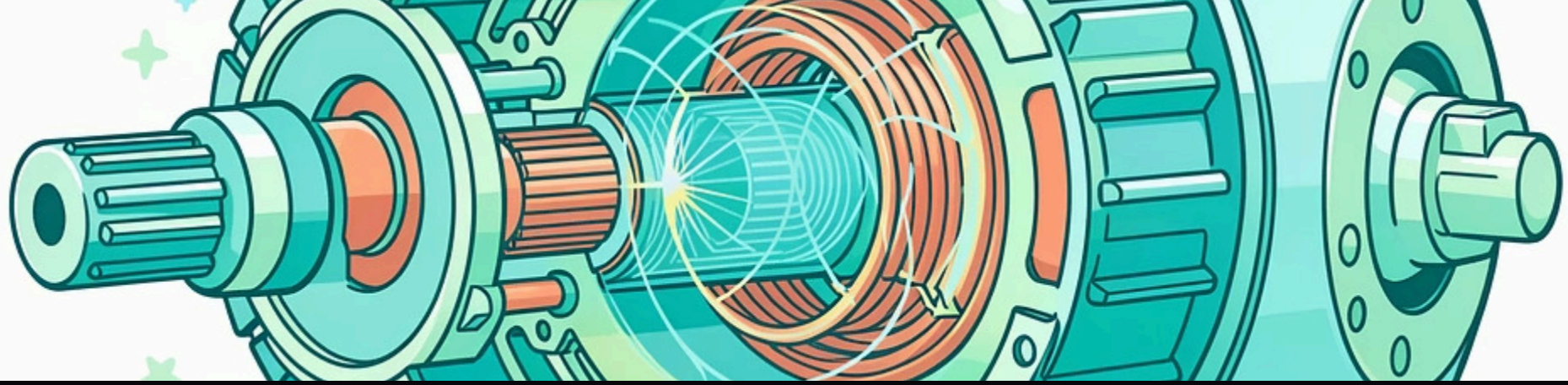
Transformers

Transfer electrical energy between circuits through electromagnetic induction.

Transducers

Convert one form of energy into another for sensing and control.

These devices are widely used in industries, homes, and automation systems.



Electric Motor – Definition

> An electric motor is a device that converts electrical energy into mechanical energy.

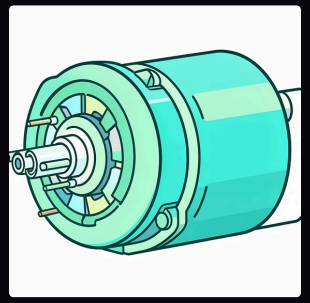
It works on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a force.

Working Principle of Motor

Lorentz Force Law

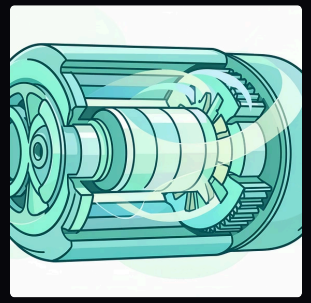
When electric current flows through the armature winding, a magnetic field is produced. The interaction between magnetic fields creates torque, causing the shaft to rotate and produce mechanical motion.

Types of Motors



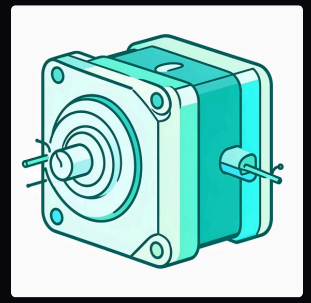
DC Motor

Operates on direct current for precise speed control.



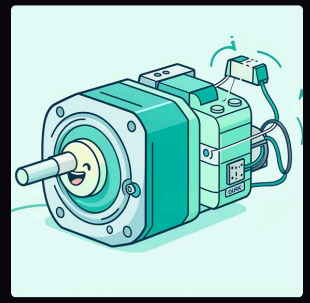
AC Motor

Operates on alternating current. Includes induction and synchronous motors.



Stepper Motor

Moves in fixed steps for precise positioning.



Servo Motor

Provides precise position control with feedback.

Applications of Motors

Electric Fans

Water Pumps

Elevators

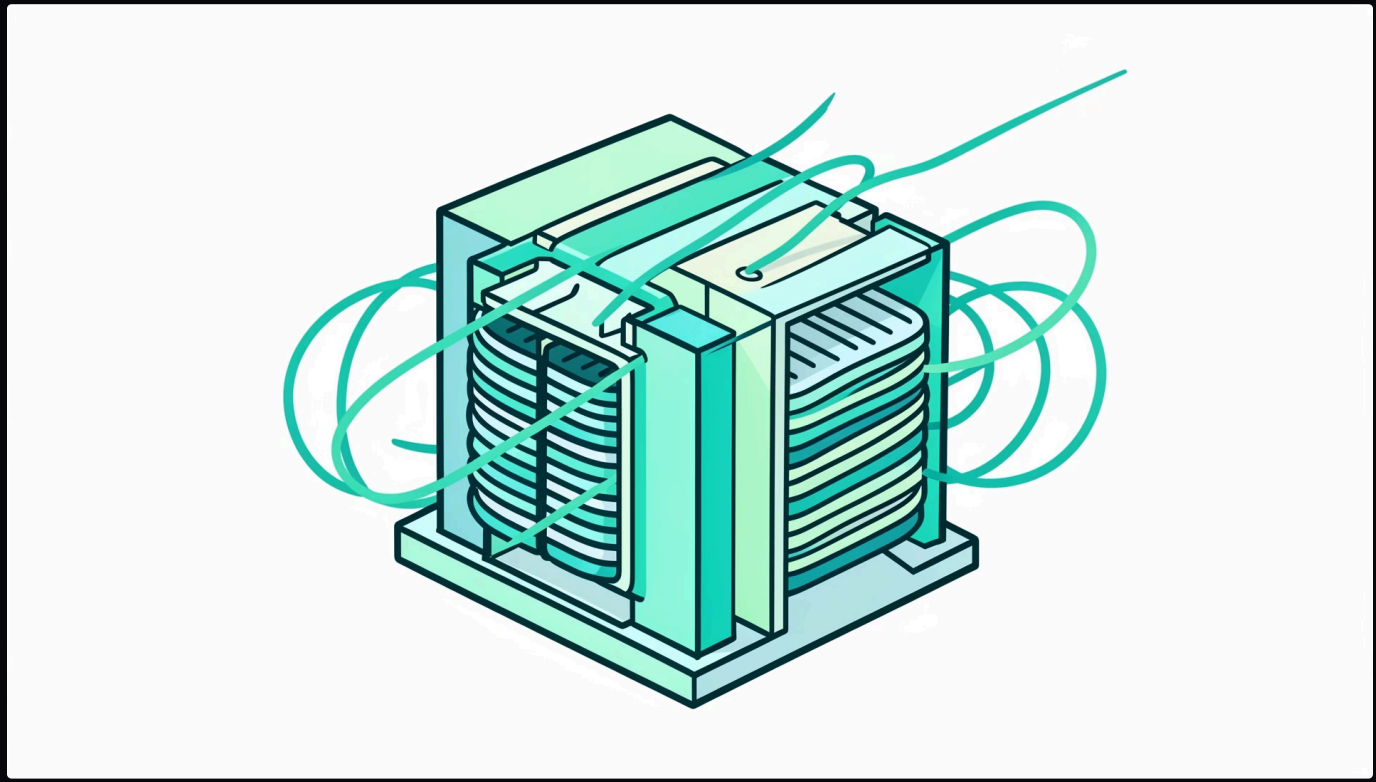
Electric Vehicles

Industrial Machines

Robotics

TRANSFORMERS

Transformer – Definition



A transformer is a static electrical device that transfers electrical energy from one circuit to another through electromagnetic induction.

Transformers work only with **alternating current (AC)**.

Working Principle of Transformer

Mutual Induction

AC in the primary winding produces changing magnetic flux. This flux links the secondary winding. According to Faraday's Law, voltage is induced in the secondary coil.

Voltage Equation

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

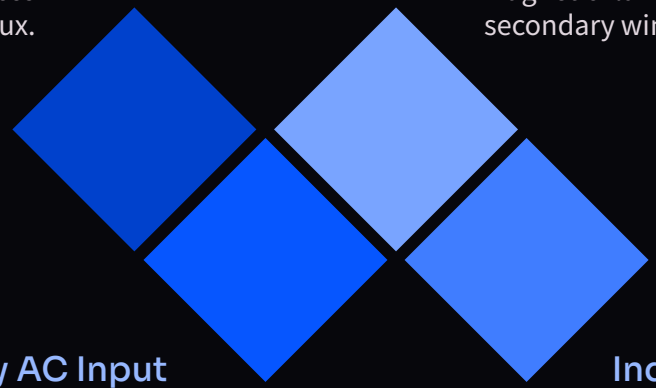
Where: Vs = Secondary voltage, Vp = Primary voltage, Ns = Secondary turns, Np = Primary turns

Changing Flux

Alternating current produces varying magnetic flux.

Flux Linkage

Magnetic flux links the secondary winding.



Primary AC Input

AC flows through the primary winding.

Induced Voltage

Voltage is induced in the secondary coil.

Types of Transformers

Step-Up Transformer

Increases voltage for efficient power transmission over long distances.

Step-Down Transformer

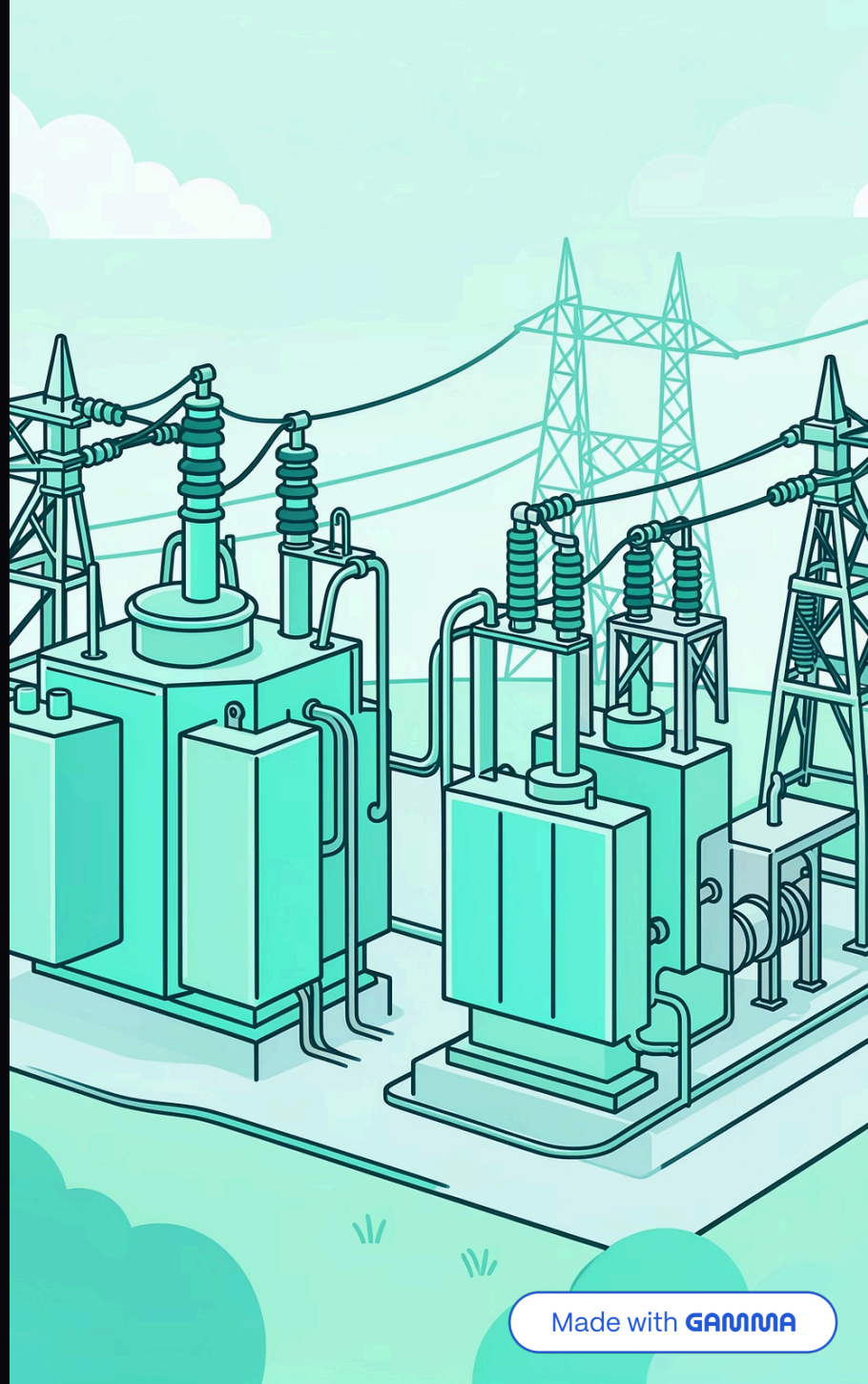
Decreases voltage for safe distribution to homes and businesses.

Isolation Transformer

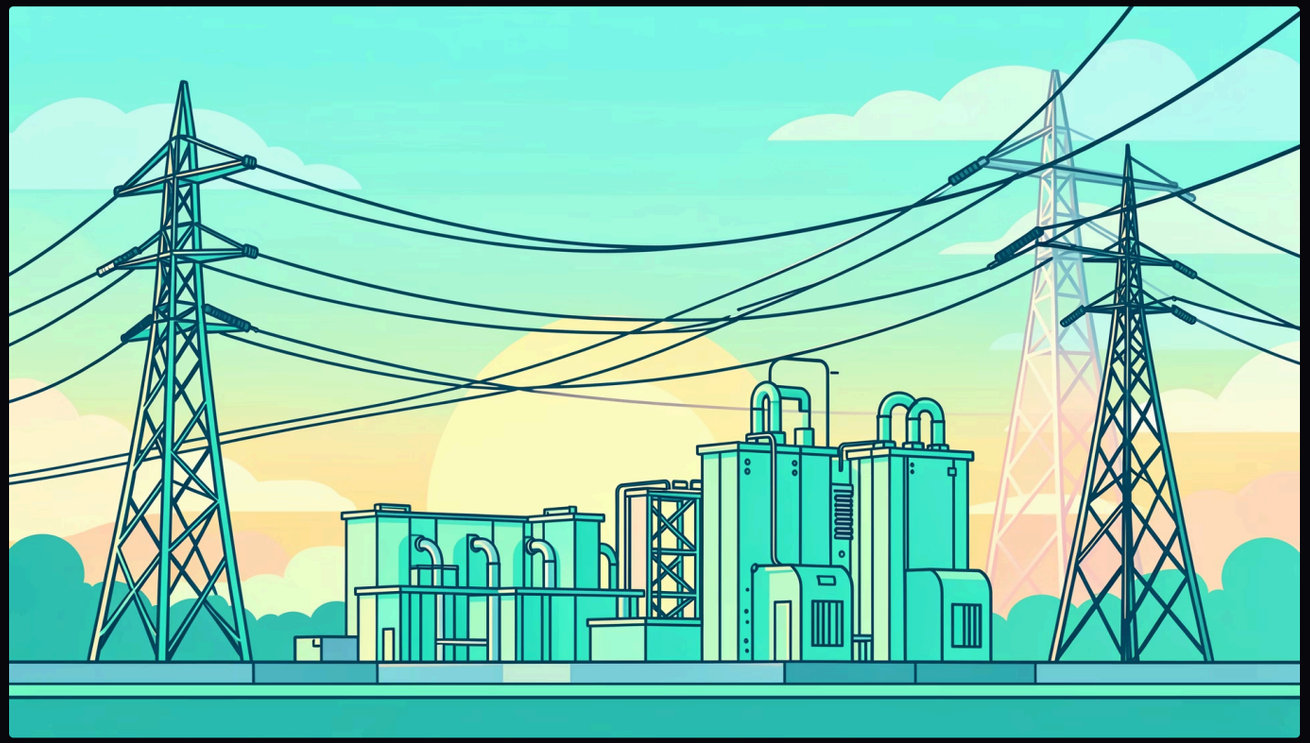
Electrically isolates circuits for safety and noise reduction.

Auto Transformer

Single winding transformer for voltage regulation and starting motors.



Applications of Transformers



- **Power Transmission**

  Distribution across national grids

- **Mobile Chargers**

  Converting mains voltage to device requirements

- **Adapters**

  Voltage conversion for electronic devices

- **Substations**

  Stepping down high voltage for local distribution

- **Industrial Power Systems**

  Providing appropriate voltage levels for machinery