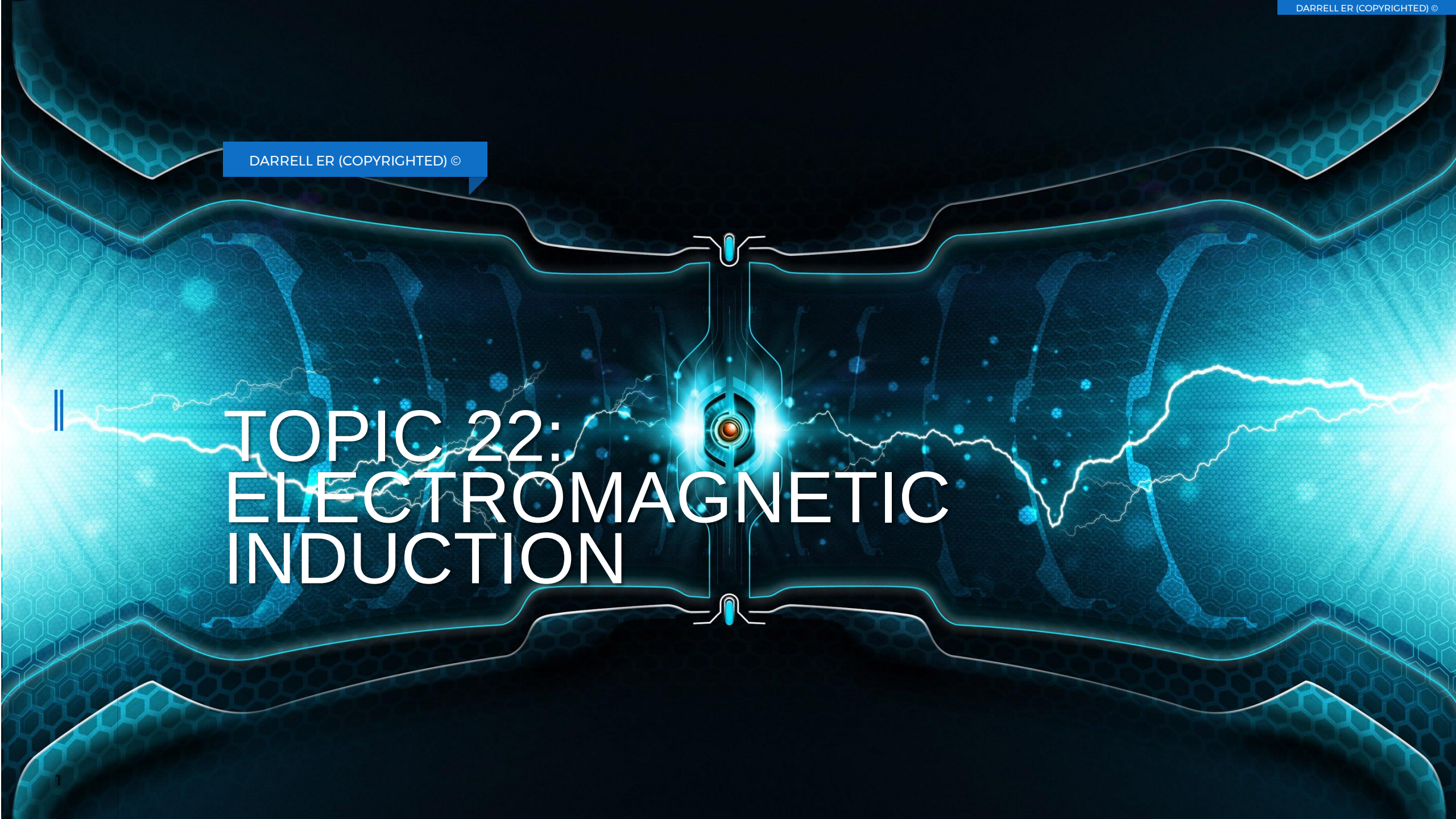

TOPIC 22: ELECTROMAGNETIC INDUCTION

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THE ABOUT

CHAPTER ANALYSIS

MASTERY

- Most difficult topic in pure Physics
- Need to be clear about the ‘Fleming’s right hand rule’ & ‘transformers’

EXAM

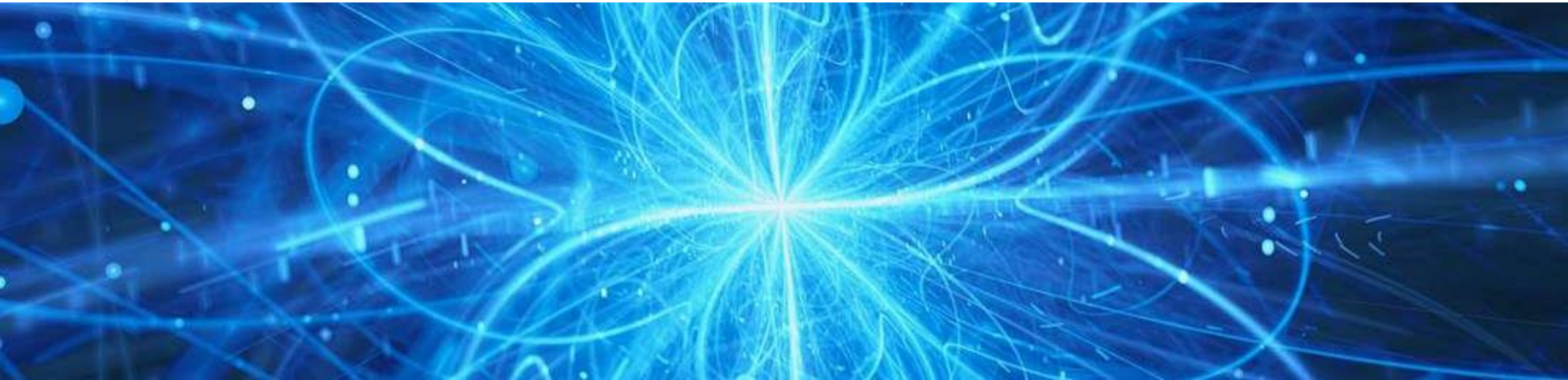
- High level of difficulty
- Usually appears in Section A & B

WEIGHTAGE

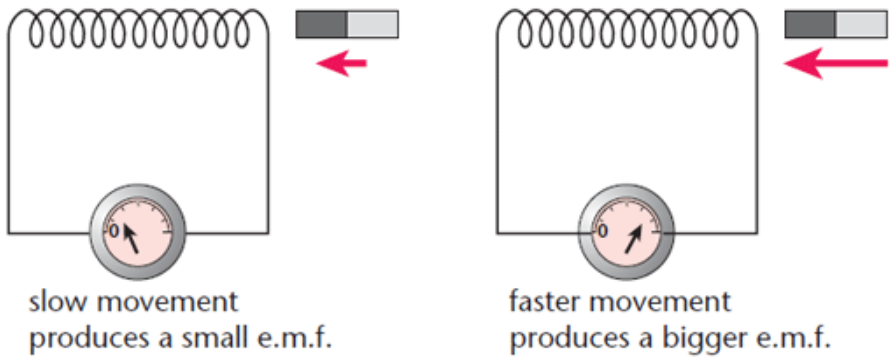
- Medium overall weightage
- Constitute to around **4%** of marks for past 5 year papers

KEY CONCEPT

FARADAY'S LAW
LEN'S LAW
FLEMING'S RIGHT HAND RULE



FARADAY'S LAW



FARADAY'S LAW

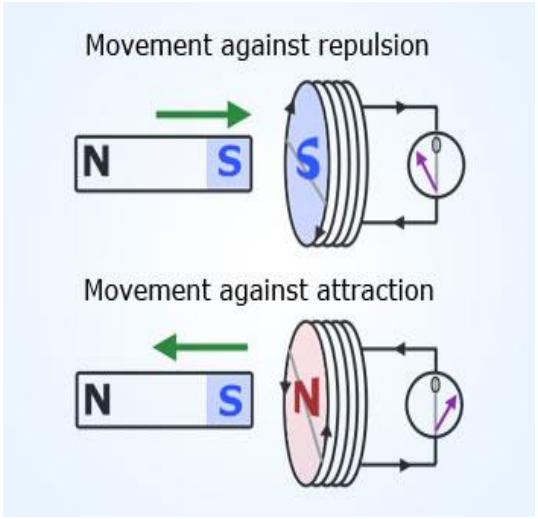
Faraday's Law of electromagnetic induction states that the **magnitude of the induced e.m.f is proportional to the rate of change of magnetic flux through the circuit.**

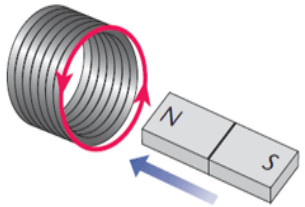
(Or proportional to the rate at which the magnetic field lines are cut)

Magnitude of induced e.m.f increases:

Increasing the speed of magnet moving through the coil
Stronger magnet
Increase number of turns on coil

LEN'S LAW



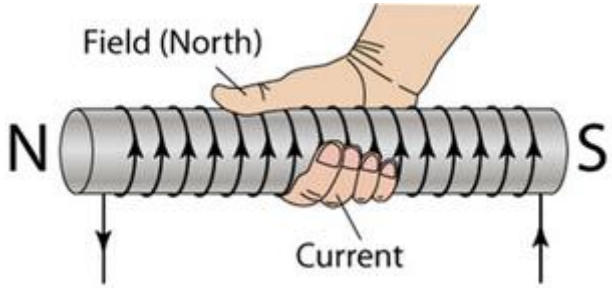


The induced current when a magnet enters a coil of wire

How to identify the poles of an electromagnet

LEN'S LAW

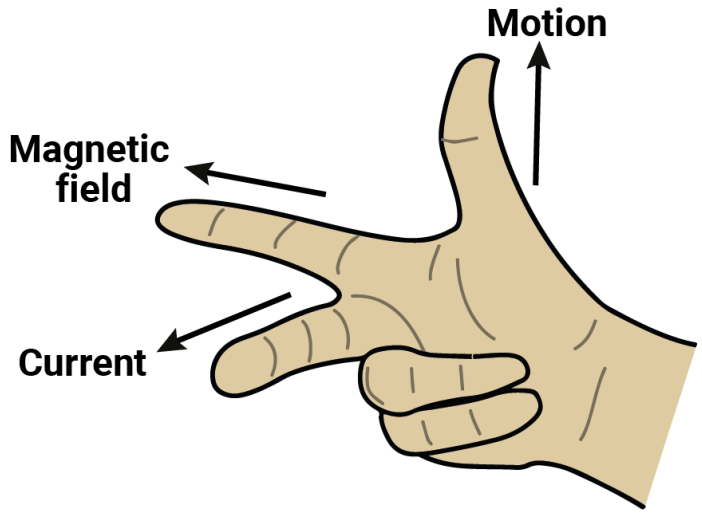
Len's Law of electromagnetic induction states that **the induced current is always in the direction that opposes the change producing it.**



*Right hand grip rule!

Thumb points to the north!

FLEMING'S RIGHT HAND RULE



FLEMING'S RIGHT HAND RULE

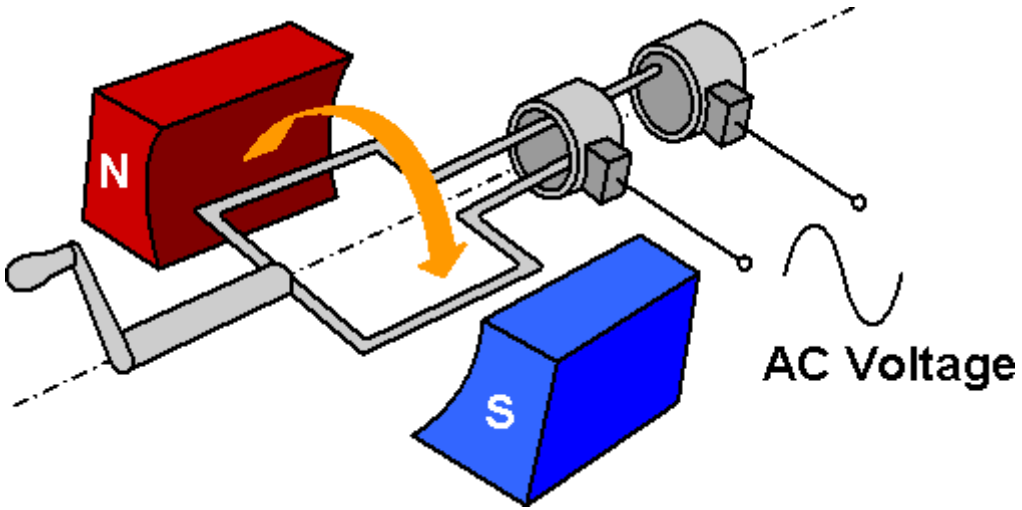
When a moving wire cuts across a perpendicular magnetic field, we can deduce the direct of the current using Fleming's Right Hand rule.

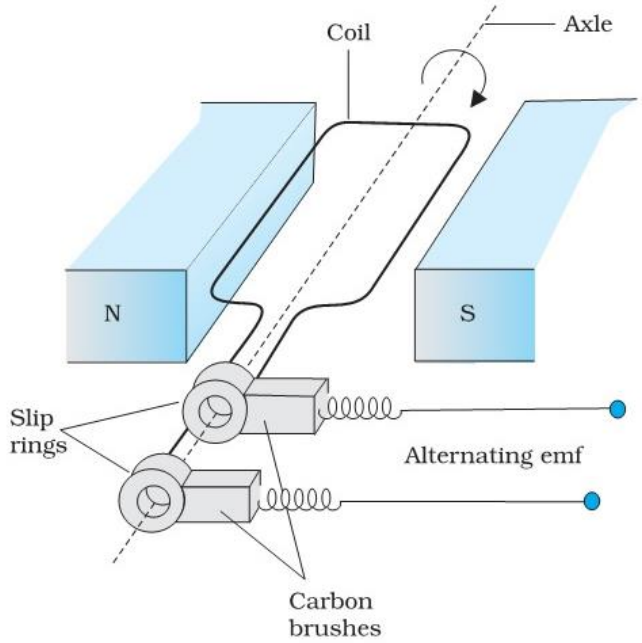
*Similar to Left Hand rule but direction of current is reversed!

KEY CONCEPT

ALTERNATING CURRENT GENERATOR
TRANSFORMERS
FULL WAVE & HALF WAVE RECTIFICATION

ALTERNATING CURRENT GENERATOR





Steps:

1. As it rotates in a clockwise manner, it cuts through the magnetic field & an induced current is generated.

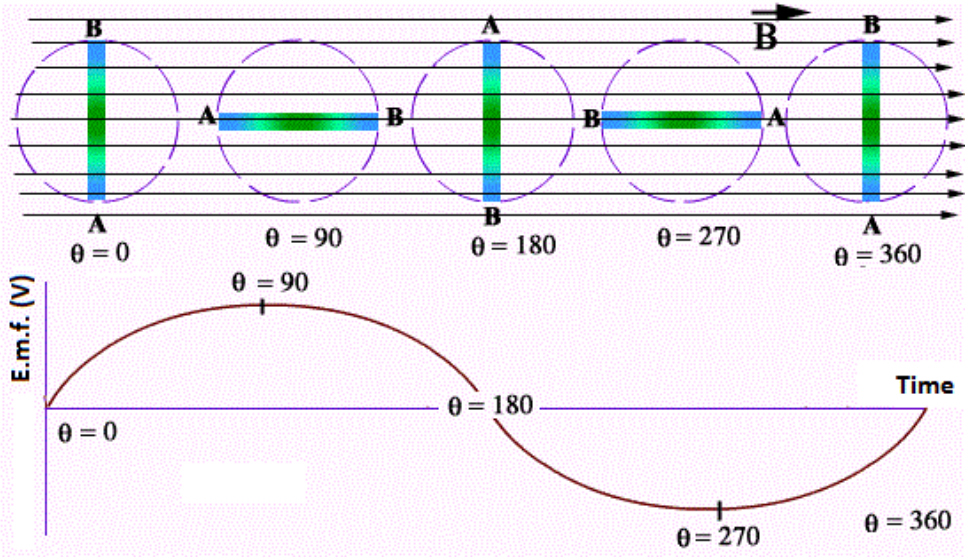
2. By Fleming's Right Hand rule, an induced current will flow in a clockwise manner around the coil.

3. The induced current flows through two slips rings which are connected to the main circuit by the carbon brushes.

4. As the coil rotates beyond 180°, it continues to rotate in a clockwise manner. However, direction of the current induced in both the coil and the circuit will be reversed.

5. Since the **direction of the current changes every time the coil passes the horizontal position**, the current is known as '**alternating current'**.

ALTERNATING CURRENT GENERATOR



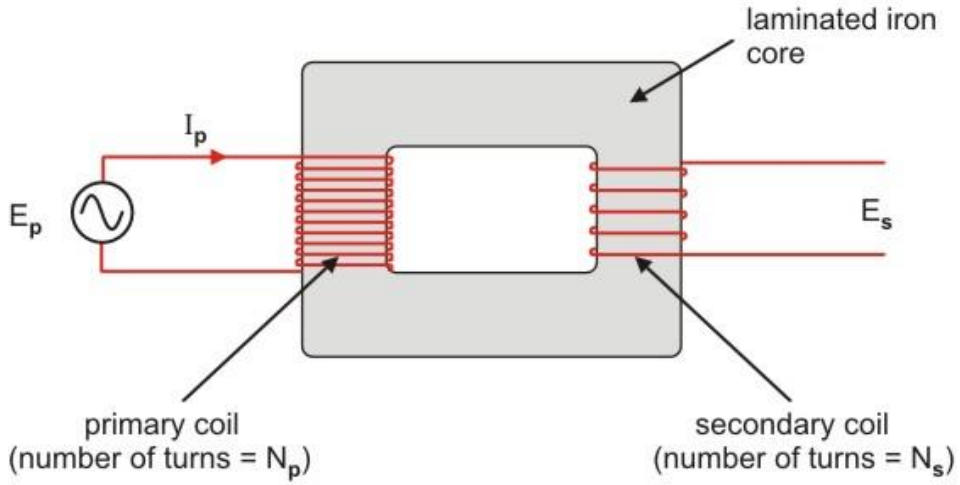
VOLTAGE OUTPUT OF A.C GENERATOR

The voltage output of an A.C generator can be measured using a cathode-ray oscilloscope.

Magnitude of induced emf can be increased by:

- Increasing speed of rotation of the coil
- Increasing number of turns of the coil
- Using a soft iron core to concentrate the magnetic field lines through the coil
- Using stronger magnets

TRANSFORMERS



TRANSFORMERS

Transformers comprise of two separate circuits, connected via a soft iron core which runs through the coils of the two circuits.

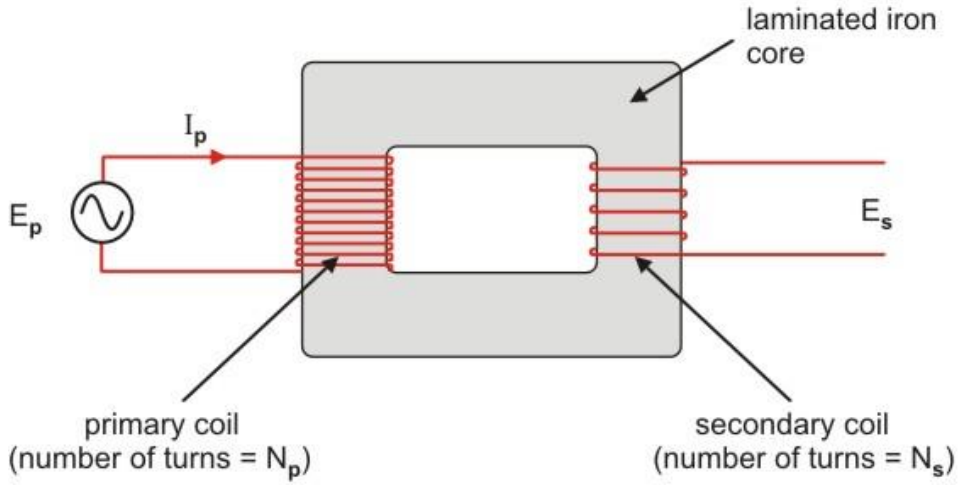
As the main voltage for every country is fixed, the transformers are necessary to increase (step up) or decrease (step down) the input voltage such that the output voltage can be suitable for different electrical appliances.

How a transformer works:

The primary circuit is connected to an A.C supply it creates a magnetic field. These **magnetic field lines are concentrated by the soft iron core & directed towards the secondary coil.**

As the current at **primary circuit is constantly alternating**, the **constant change in magnetic flux will continuously induce a current in the secondary coil** which is used to power a load.

TRANSFORMERS



TRANSFORMERS (FORMULA)

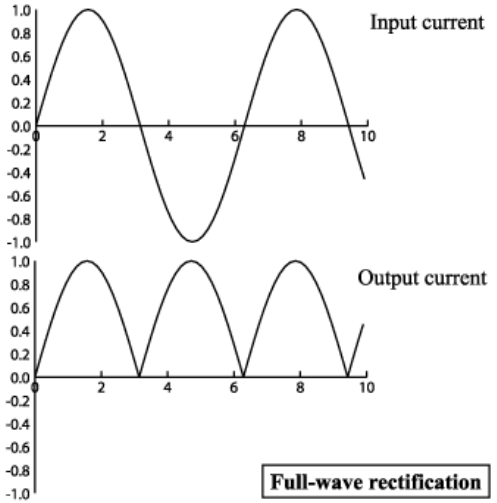
$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

V_s: Secondary voltage
V_p: Primary Voltage
N_s: Number of turns (secondary)
N_p: Number of turns (primary)

$$V_p I_p = V_s I_s$$

V_p: Primary Voltage
I_p: Primary Current
V_s: Secondary Voltage
I_s: Secondary current

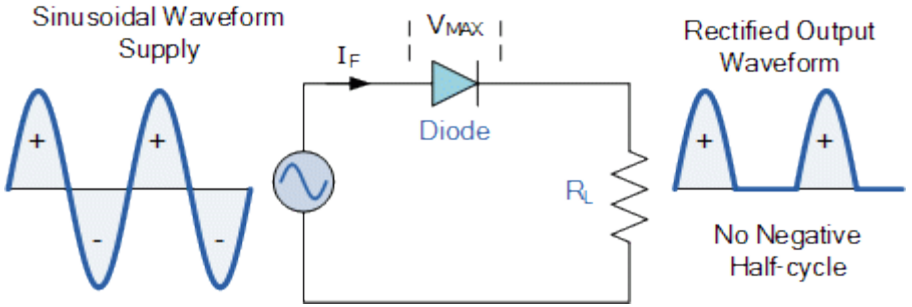
RETIFICATION



HALF-WAVE RECTIFICATION

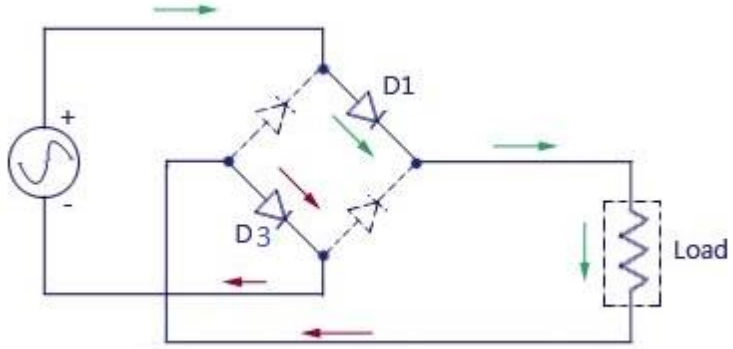
An **alternating current can be converted in a direct current** using a diode.

This ensures that current can only flow in a single direction; however, current is zero every alternate half cycle.



FULL-WAVE RECTIFICATION

Full-wave rectification uses a series of diodes to ensure constant output in a single direction.



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