



# **SNS COLLEGE OF TECHNOLOGY**

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade

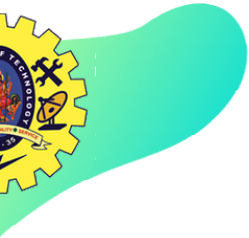
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **19EET101 / BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING I YEAR / I SEMESTER**

### **UNIT-II: ELECTRICAL MACHINES**

# **PRINCIPLE OF OPERATION OF DC GENERATOR**

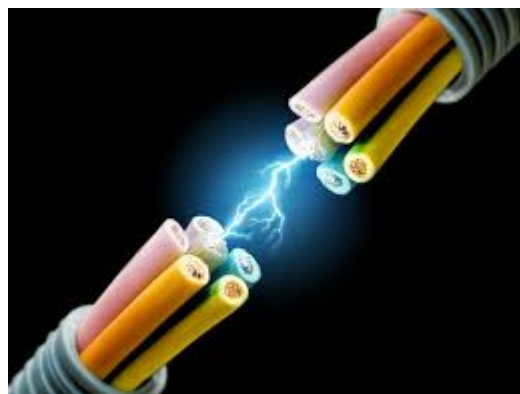




# TOPIC OUTLINE



- ✓ Faraday's Laws
- ✓ Lenz Law
- ✓ Working Principle
- ✓ EMF Equation
- ✓ Applications



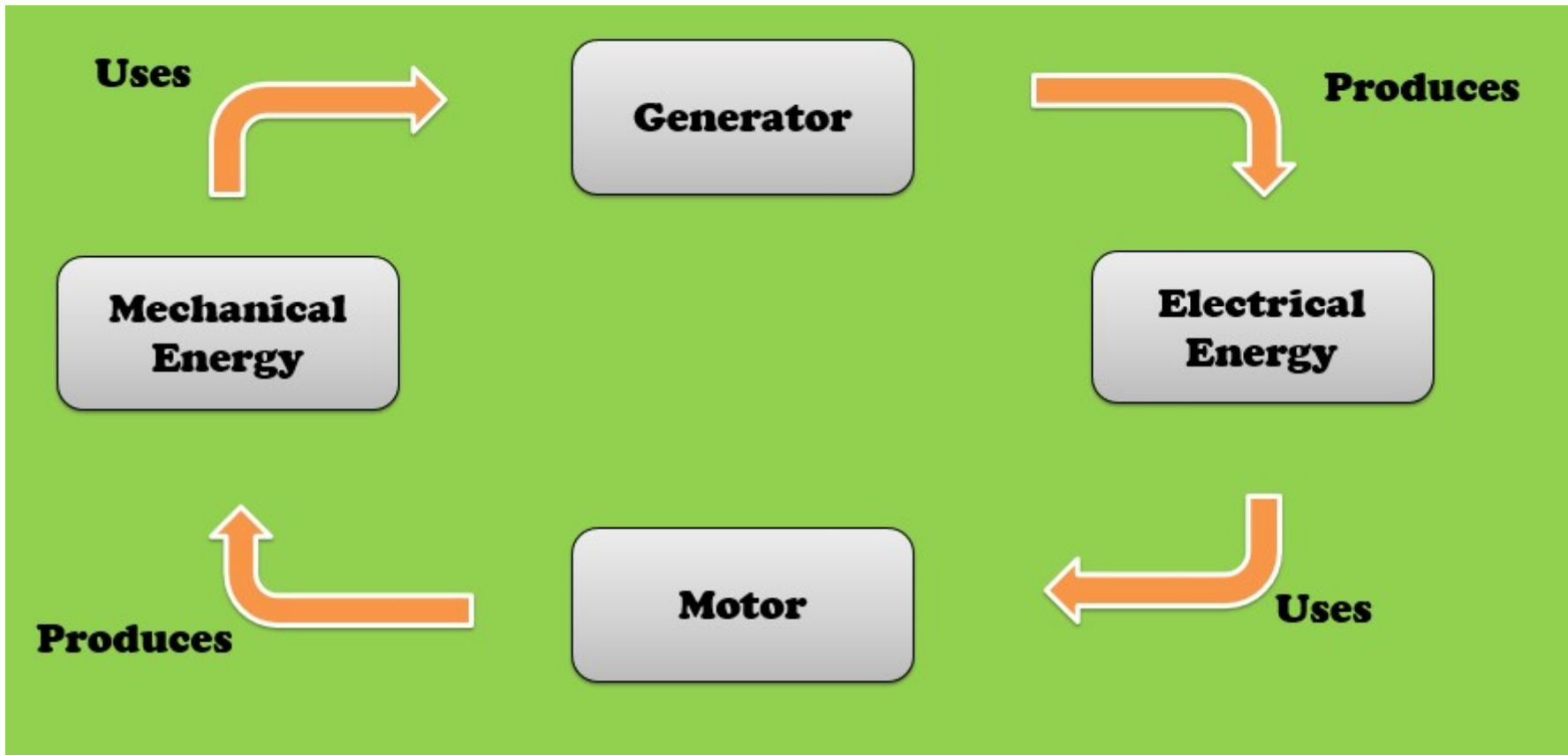


# Identify the Component





# GENERATOR/MOTOR





# **PRINCIPLE OF OPERATION OF DC GENERATOR**

## **Video**

<https://www.youtube.com/watch?v=Jh167TEECBk>





# Faraday's Law of Electromagnetic Induction



## First Law :

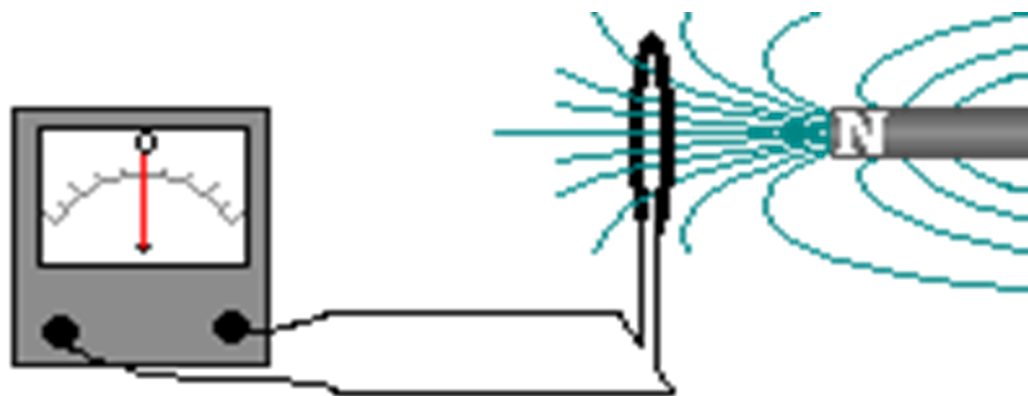
Whenever the magnetic flux linked with a circuit changes, an e.m.f. is always induced in it.

or

Whenever a conductor cuts magnetic flux, an e.m.f. is induced in that conductor.

## Second Law :

The magnitude of the induced e.m.f. is equal to the rate of change of flux linkages.

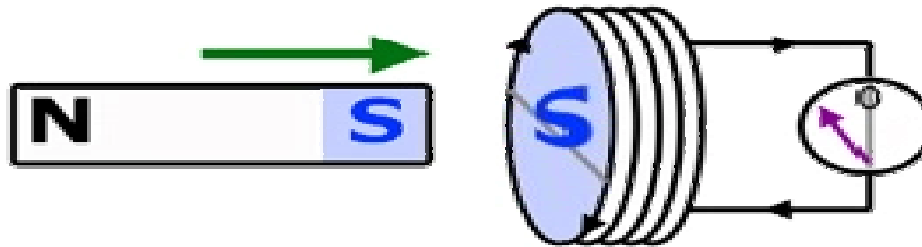




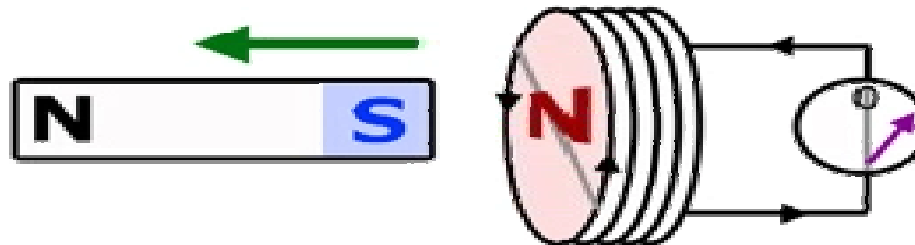
# Lenz Law

“The direction of induced E.M.F in a coil (conductor) is such that it opposes the cause of producing it..”

movement **against** repulsion



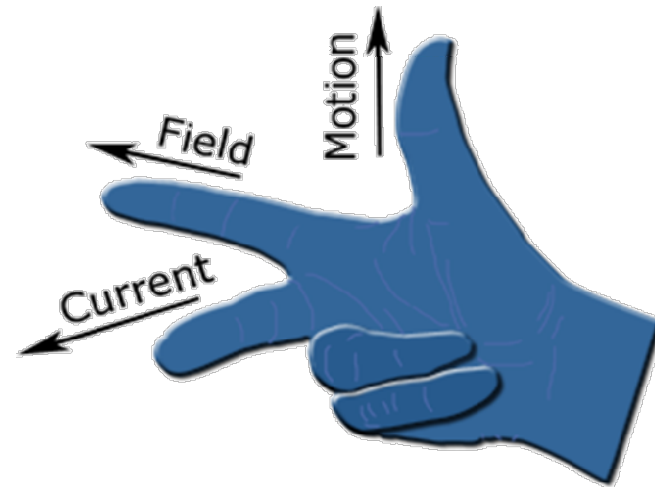
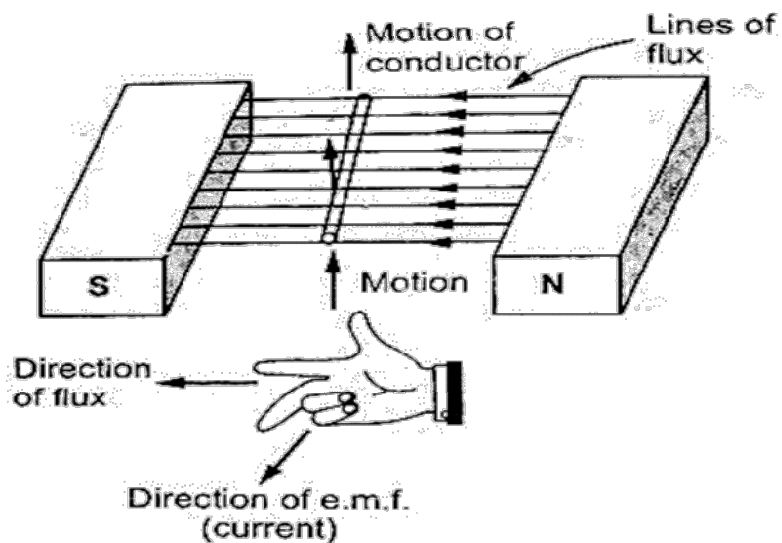
movement **against** attraction





# Fleming's Right Hand Rule

- The Thumb represents the direction of Motion of the conductor.
- The First finger (four finger) represents Field.
- The Second finger (Middle finger) represents Current

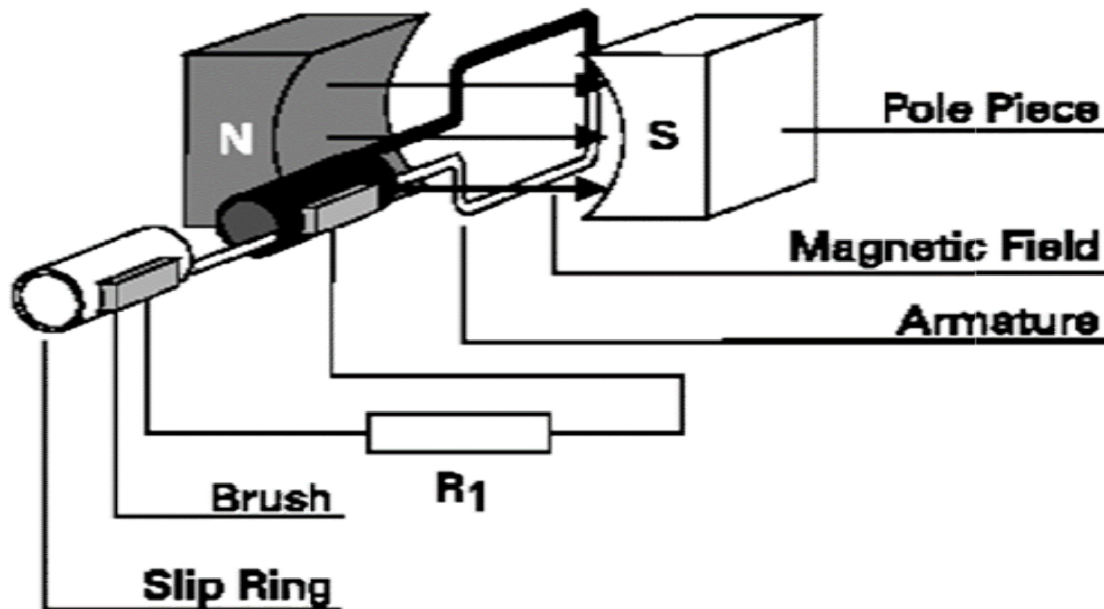






# Basic requirements to be satisfied for generation of E.M.F

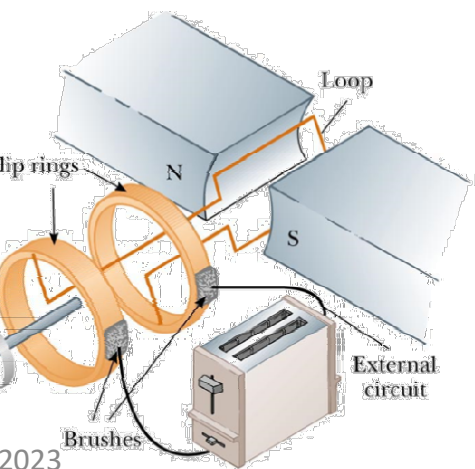
1. A uniform Magnetic field
2. A System of conductors
3. Relative motion between the magnetic field and conductors



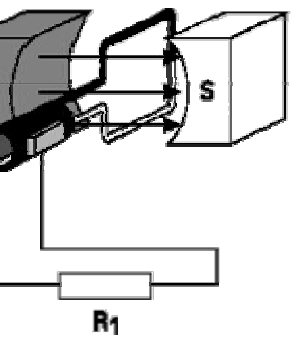


# PRINCIPLE OF OPERATION

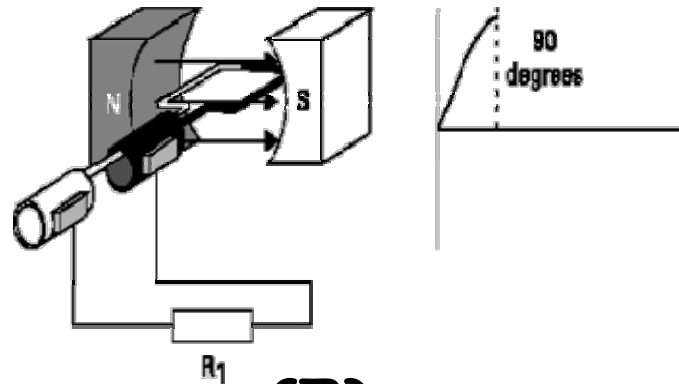
- ✓ DC generator converts mechanical energy into electrical energy.
- ✓ when a conductor move in a magnetic field in such a way conductors cut across a magnetic flux of lines and e.m.f. produces in a generator and it is defined by faradays law of electromagnetic induction e.m.f. causes current to flow if the conductor circuit is closed.



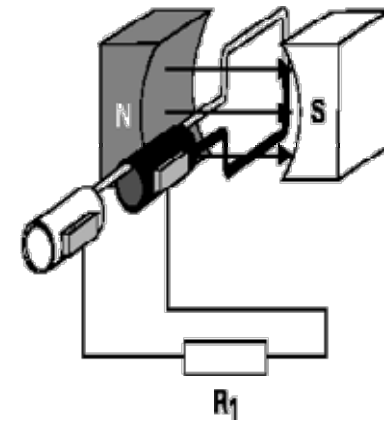
# Operation of a Generator



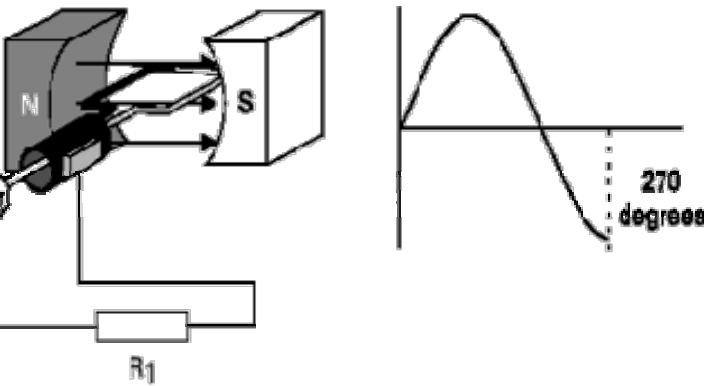
(A)



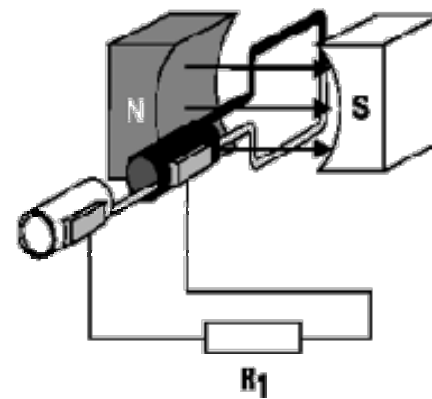
(B)



(C)

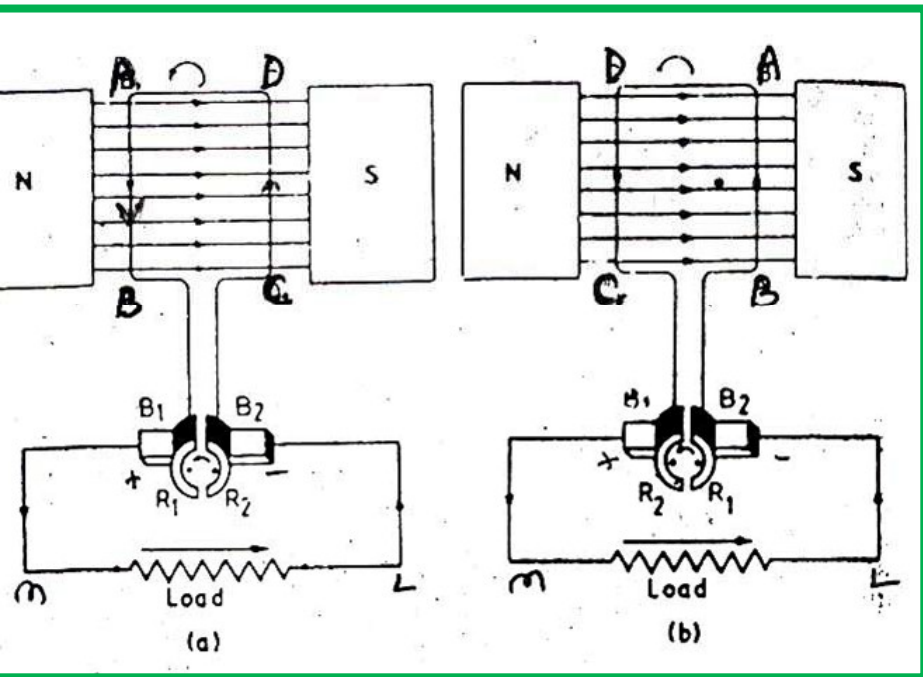


(D)



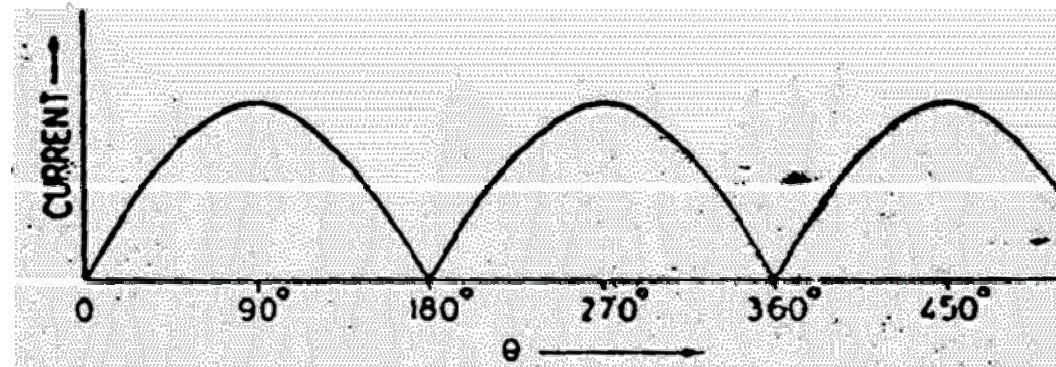
(E)

# Operation of DC Generator - Split Rings



1st half cycle ( $0^\circ$  to  $180^\circ$ ) Path of current  
 $ABR_1B_2MLR_2B_1CD$

2nd half cycle ( $180^\circ$  to  $360^\circ$ ) Path of current  
 $DCR_2B_1MLB_2R_1BA$





# EMF Equation of DC Generator



As the armature rotates, a voltage is generated in its coils. In the case of a generator, the emf of rotation is called the Generated emf or Armature emf and is denoted as  $E_r = E_g$ .

$P$  – number of poles of the machine

$\phi$  – Flux per pole in Weber.

$Z$  – Total number of armature conductors.

$N$  – Speed of armature in revolution per minute (r.p.m).

$A$  – number of parallel paths in the armature winding.

If the DC Machine is working as a Motor, the induced emf is given by the equation shown below:

$$E_g = \frac{PZ \phi N}{60 A} \quad \text{volts}$$





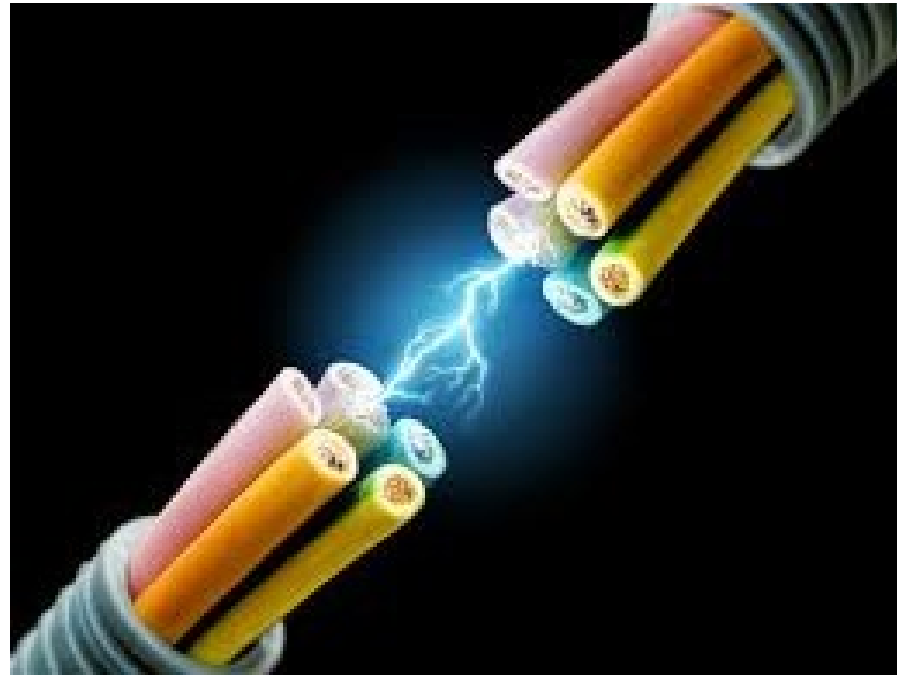
# APPLICATIONS

- They are used for **general lighting**.
- They are used to **charge battery**.
- They are used for giving **the excitation** to the alternators.
- They are also used for **small power supply** (such as a portable generator).
- They are used for supplying field excitation current in **DC locomotives** for regenerative braking.
- This types of generators are used as boosters to compensate the voltage drop in the feeder in various types of distribution systems such as **railway service**.





# RECAP...



# ...THANK YOU

