SNS COLLEGE OF TECHNOLOGY

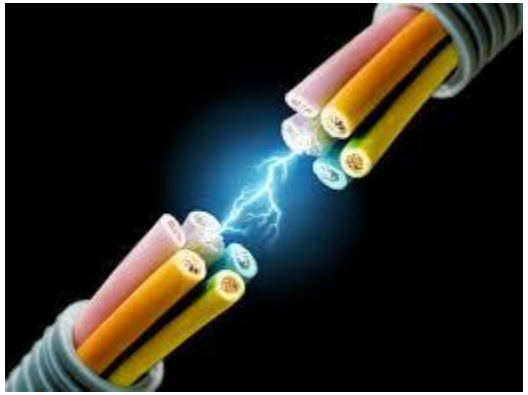
(An Autonomous Institution)
COIMBATORE-35
Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

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

UNIT-II: ELECTRICAL MACHINES

PRINCIPLE OF OPERATION OF DC GENERATOR

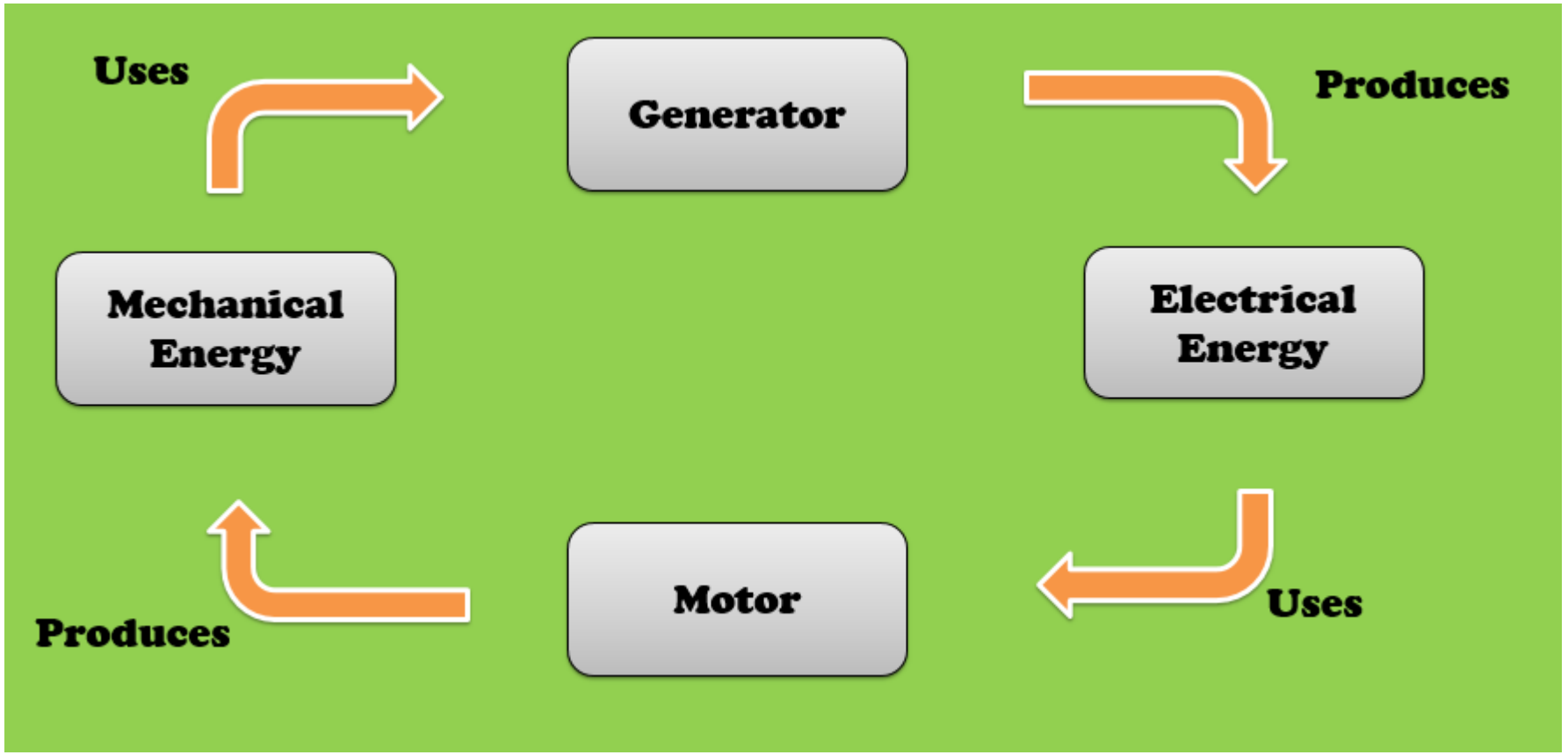
TOPIC OUTLINE



- ✓ 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 :

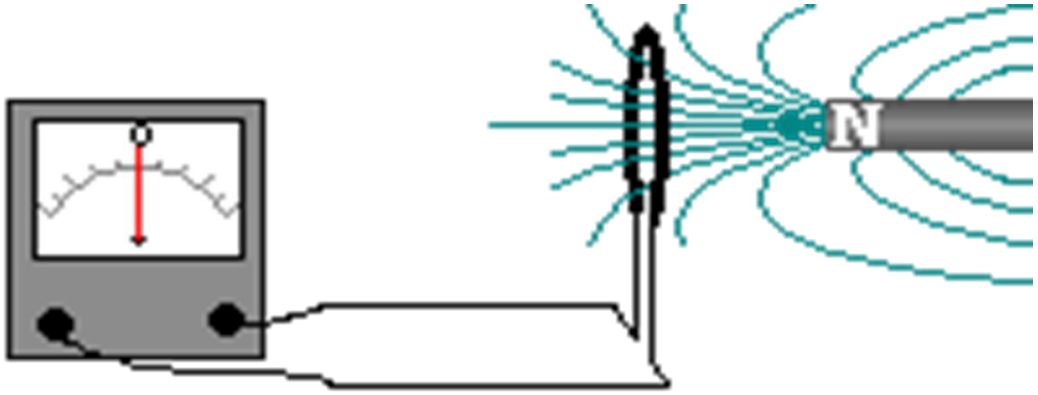
Whenever the magnetic flux linked with a circuit changes, an e.m.f. is always induced in it.

or

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

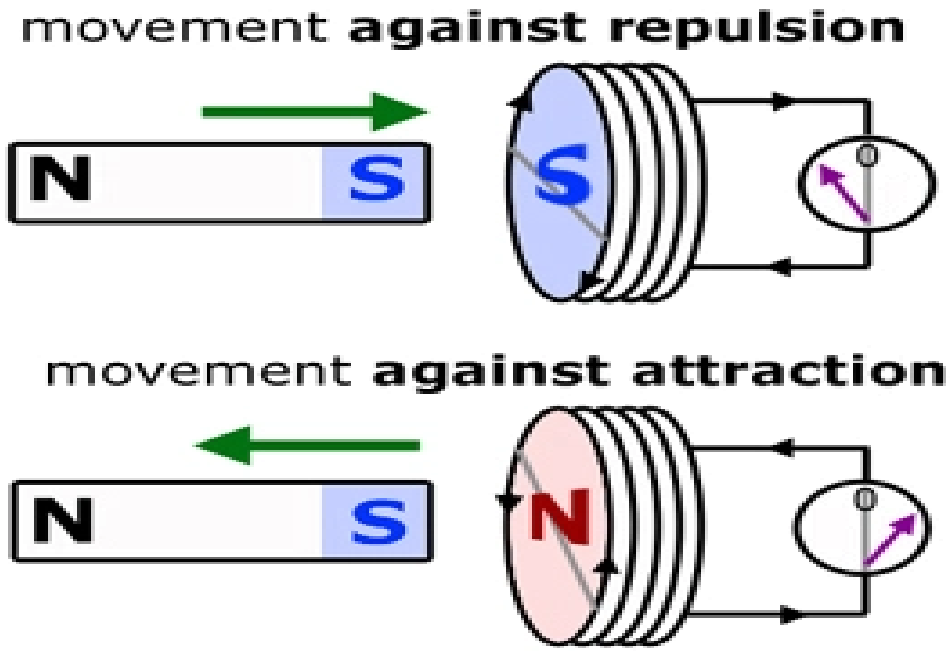
Second Law :

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



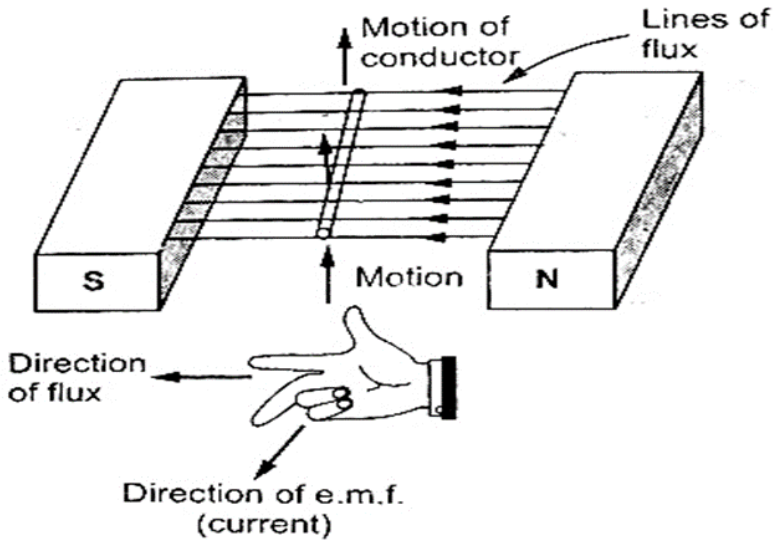
Lenz Law

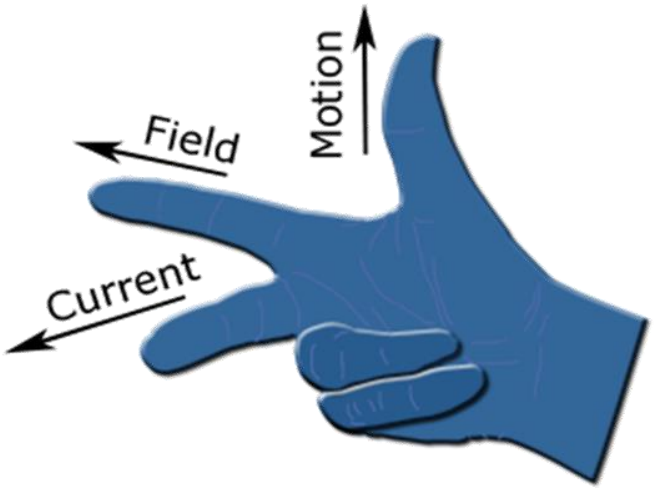
"The direction of induced E.M.F in a coil (conductor) is such that it opposes the cause of producing it.."



Fleming's Right Hand Rule

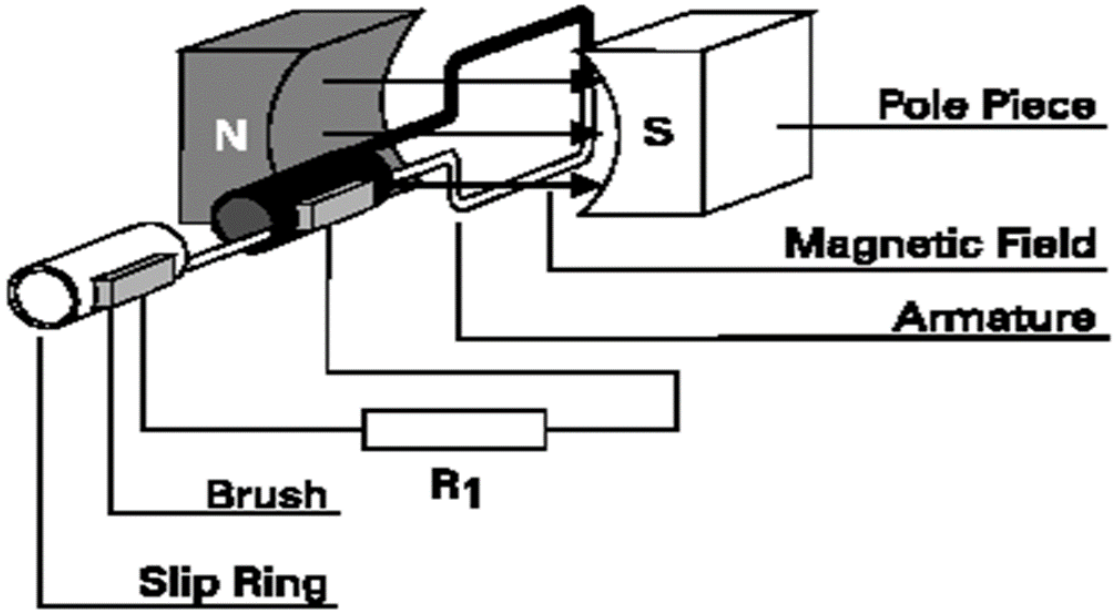
- The Thumb represents the direction of Motion of the conductor.
- The First finger (four finger) represents Field.
- The Second finger (Middle finger) represents Current





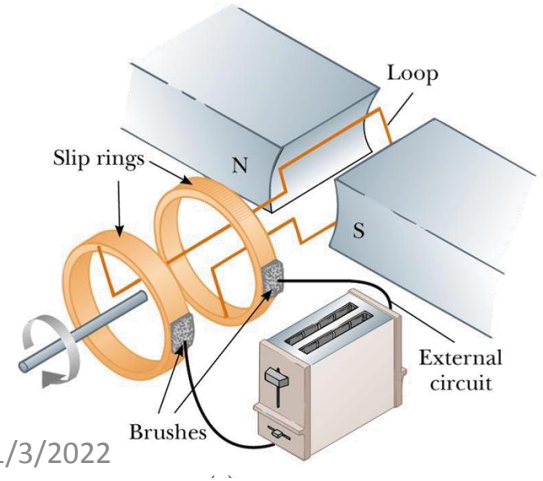
Basic requirements to be satisfied for generation of E.M.F

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

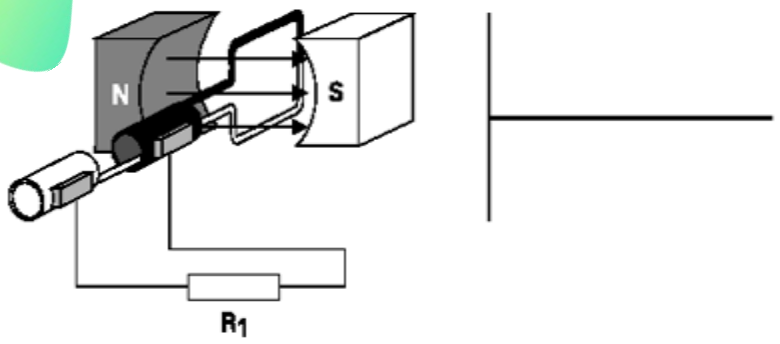


PRINCIPLE OF OPERATION

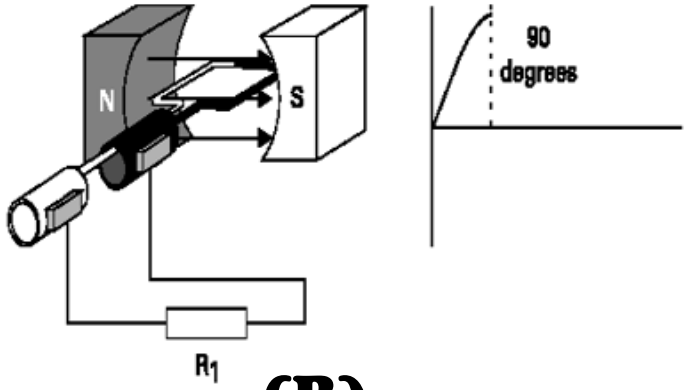
- ✓ DC generator converts mechanical energy into electrical energy.
- ✓ when a conductor move in a magnetic field in such a way conductors cuts across a magnetic flux of lines and e.m.f. produces in a generator and it is defined by faradays law of electromagnetic induction e.m.f. causes current to flow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



Operation of a Generator



(A)



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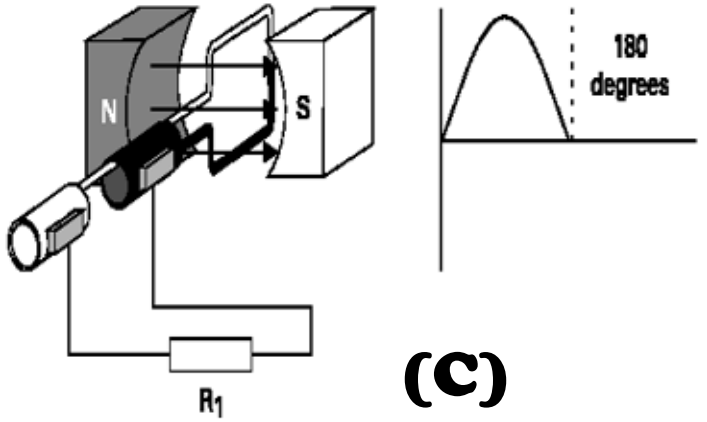

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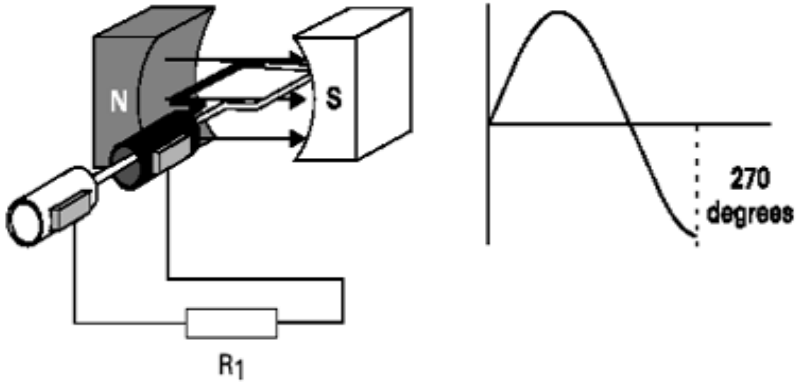

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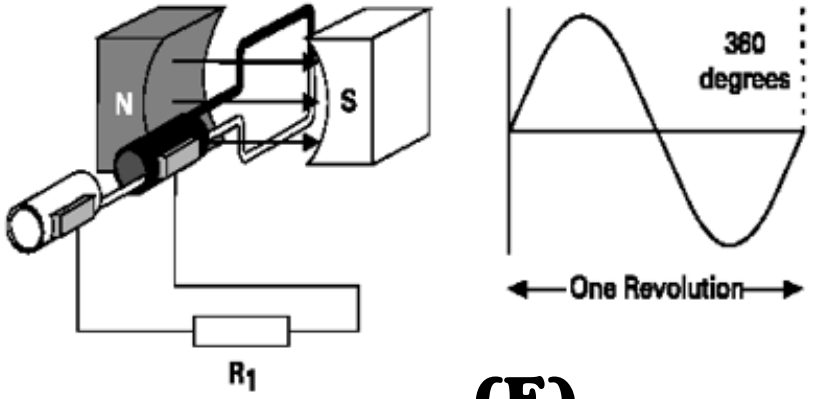
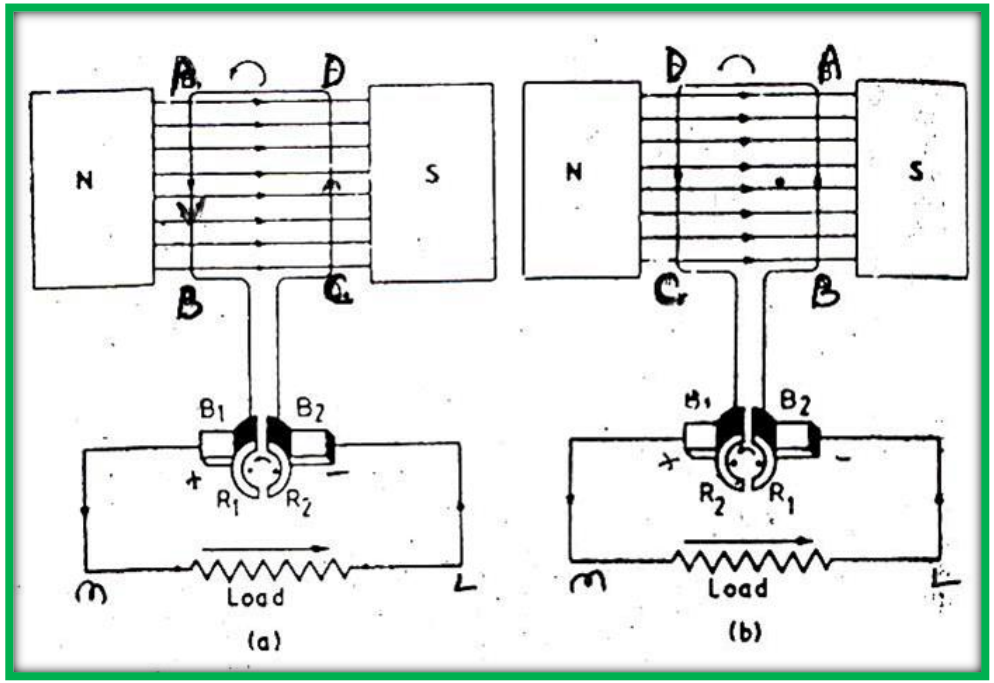


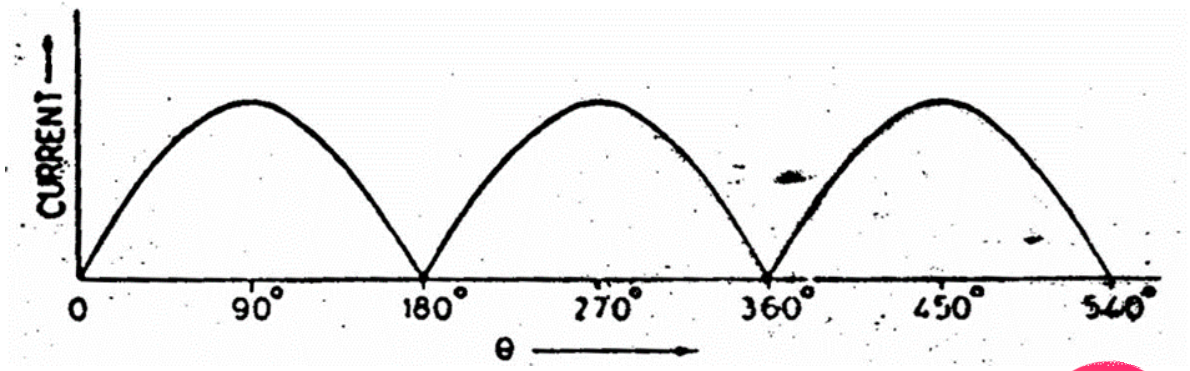
(E)

Operation of DC Generator – Split Rings



1st half cycle(0^0 to 180^0) Path of current $ABR_1B_1MLR_2B_2CD$

2st half cycle(180^0 to 360^0) 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 Er = Eg.

P – number of poles of the machine
ϕ – 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.

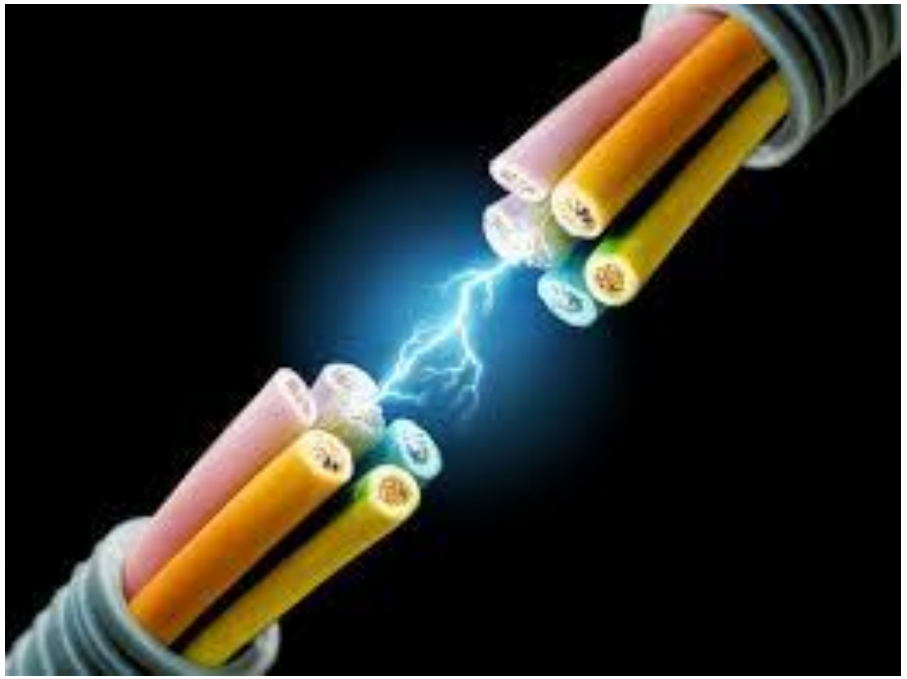
If the DC Machine is working as a Motor, the induced emf is given by the equation shown below:

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

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 breaking.
- 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