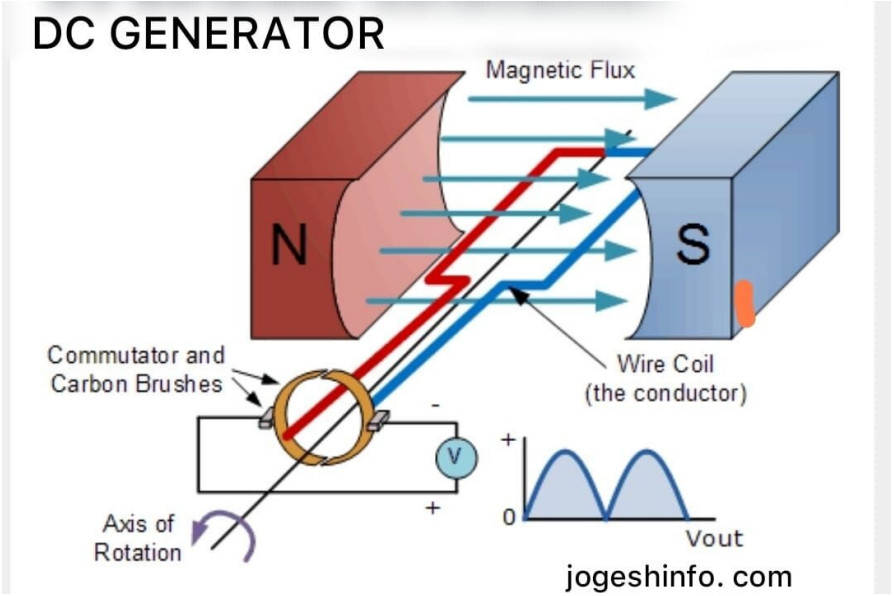
DC Generators

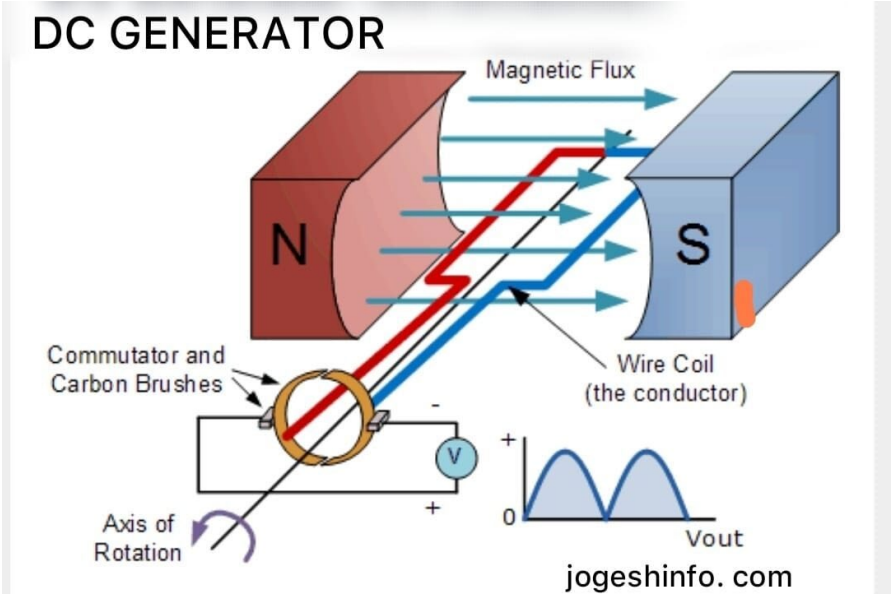
DC Generator Construction

- DC Generators are almost exactly the same as DC motors in terms of construction
- It contains the same items we've learnt about in motors;
  - Commutators/Split Ring
  - Brushes
  - Armature/Loop/Windings
  - Stators



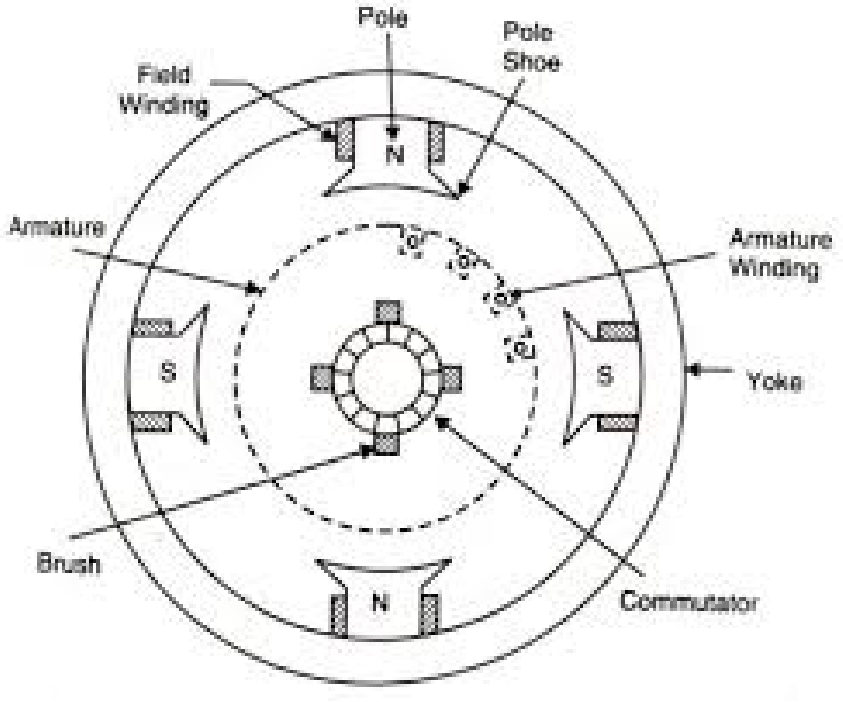
DC Generator Construction

- The commutator ensures that the current is always flowing the same way by swapping contacts
- The armature (windings) rotate because of some external force, they have the current induced in them
- The brushes ensure contact is always made with the split ring
- The stator creates the magnetic field to induce the current



Parts of a DC Generator Stator

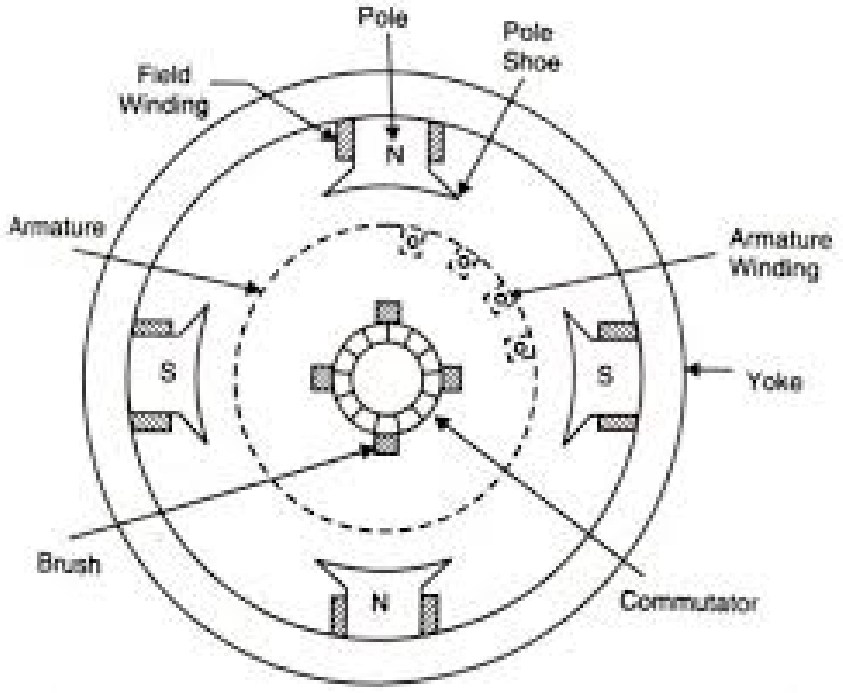
- The poles in a DC generator stator are what form the magnetic field
- They can either be PMDC (permanent magnet) or electromagnet (series or shunt)
- Often, they are electromagnets as they can produce a stronger field and can be controlled.



Parts of a DC Generator Stator

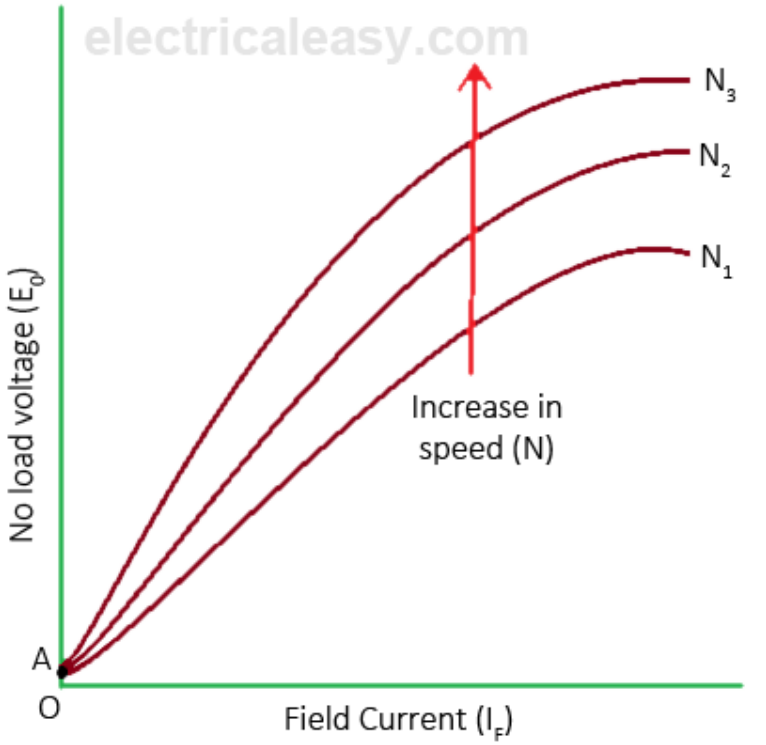
- The poles themselves are often chunks of metal formed to produce a wide field and then have field windings wrapped round making electromagnets

- The yoke holds the poles in place, acts as a strong outer shell to protect the motor and helps the magnetic field by acting as a good material to return the field.



Open Circuit Characteristics

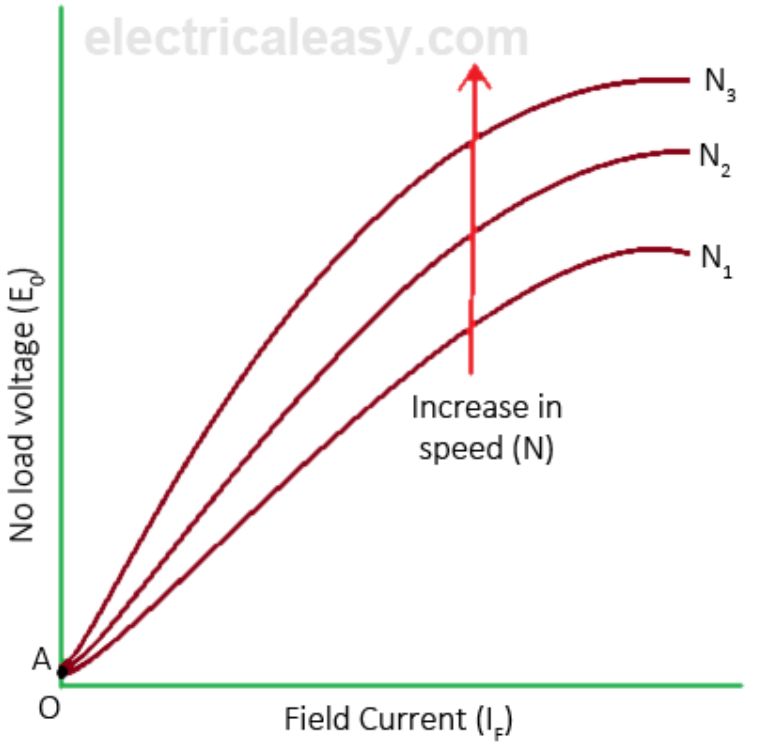
- The graph on this slide is only true when:
- There is no electrical device connected to the circuit to use the power generated (No Load)
- The generator is spinning at a constant speed



Open Circuit Characteristic (O.C.C.)

Open Circuit Characteristics

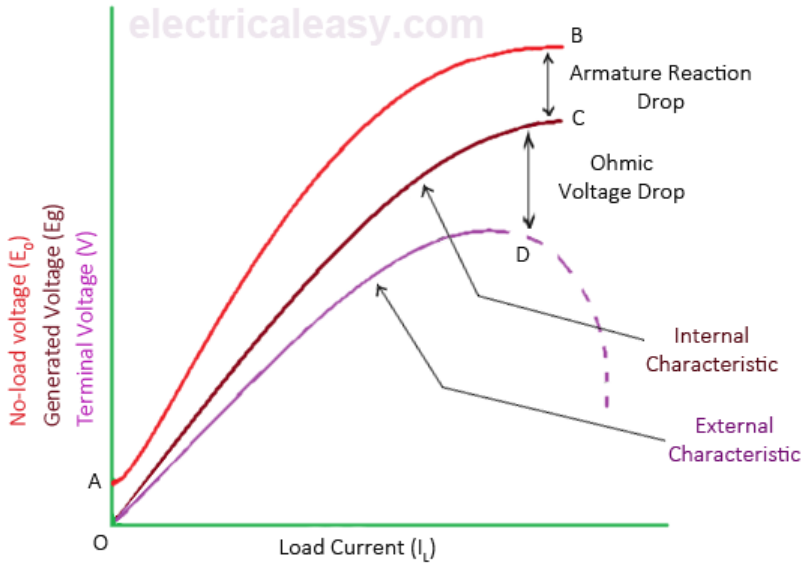
- As we can see from the graph as we increase the current going through the windings on the poles the voltage generated increases
- This is true until the poles are magnetically saturated at which point the voltage stops increasing gradually
- As you can see from the graph if we increase speed, we also get a higher voltage from field current values



Open Circuit Characteristic (O.C.C.)

Load Characteristics

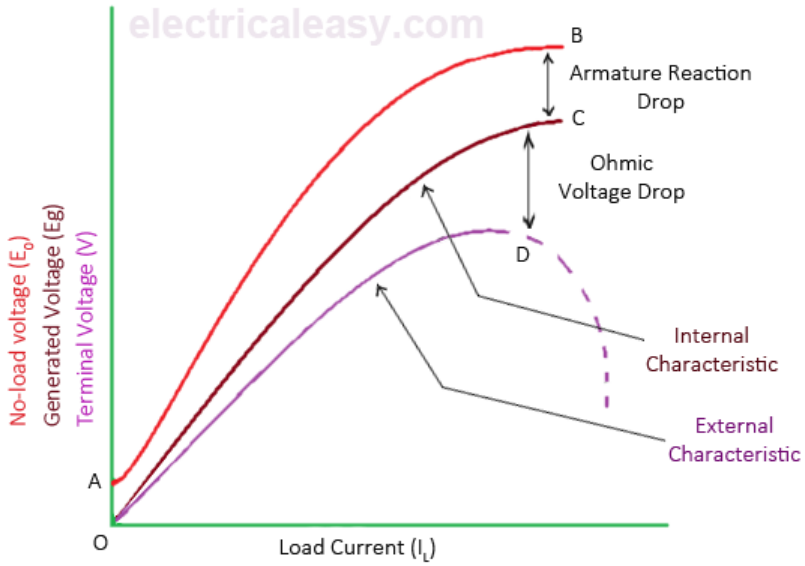
- Under load the generator output differs
- The graph shows the effect that increasing the current drawn by the external device has on several voltages
- The top red line tells us the internal voltage inside the generator before we incorporate and losses such as armature reaction or resistance drops



Characteristics of DC series generator

Load Characteristics

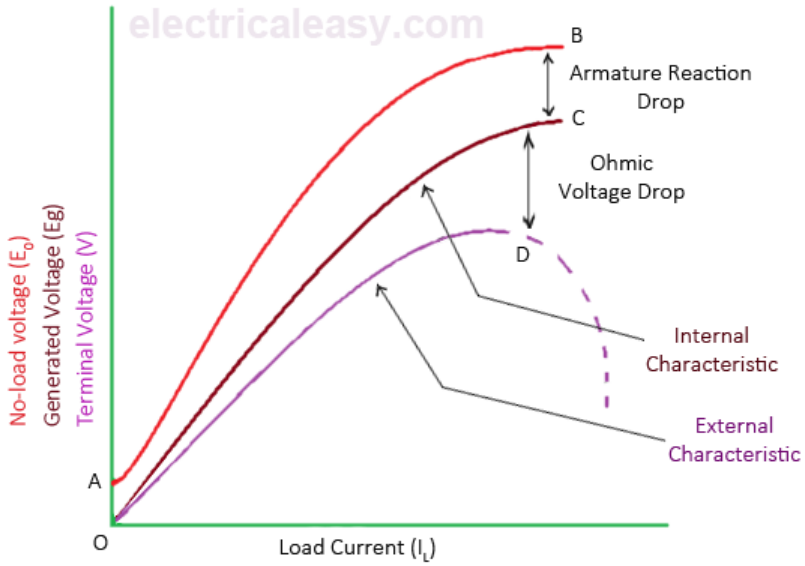
- The middle darker line incorporates the armature reaction
- As we can see from the lines this reduces the internal voltage due to loss
- The armature reaction happens because the armature forms its own magnetic field due to a current going through it.
- This weakens the pole field as they interact hence the loss.



Characteristics of DC series generator

Load Characteristics

- The bottom purple line is the actual voltage you get out of the generator
- The voltage follows the line very similarly to both the others until magnetic saturation
- At the point of magnetic saturation, the voltage starts to decrease as internal resistance inside of the generator causes more losses
- This is because current and resistance are directly linked



Characteristics of DC series generator