

SUBJECT – EC-II

BRANCH-ELECTRICAL

SEMESTER-5th SEM

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ALTERNATOR:-

AC system has a number of advantages over DC system like

- (i) The generation of AC is cheaper than that of DC.
- (ii) AC machines are simple & do not require much maintenance for their repair, during their use.
- (iii) AC can be easily be converted into DC.
- (iv) When AC is supplied at higher voltage in a long distance, the line losses are small compared to DC transmission.

These days 3-phase AC system is being exclusively used for generation, transmission & distribution of power.

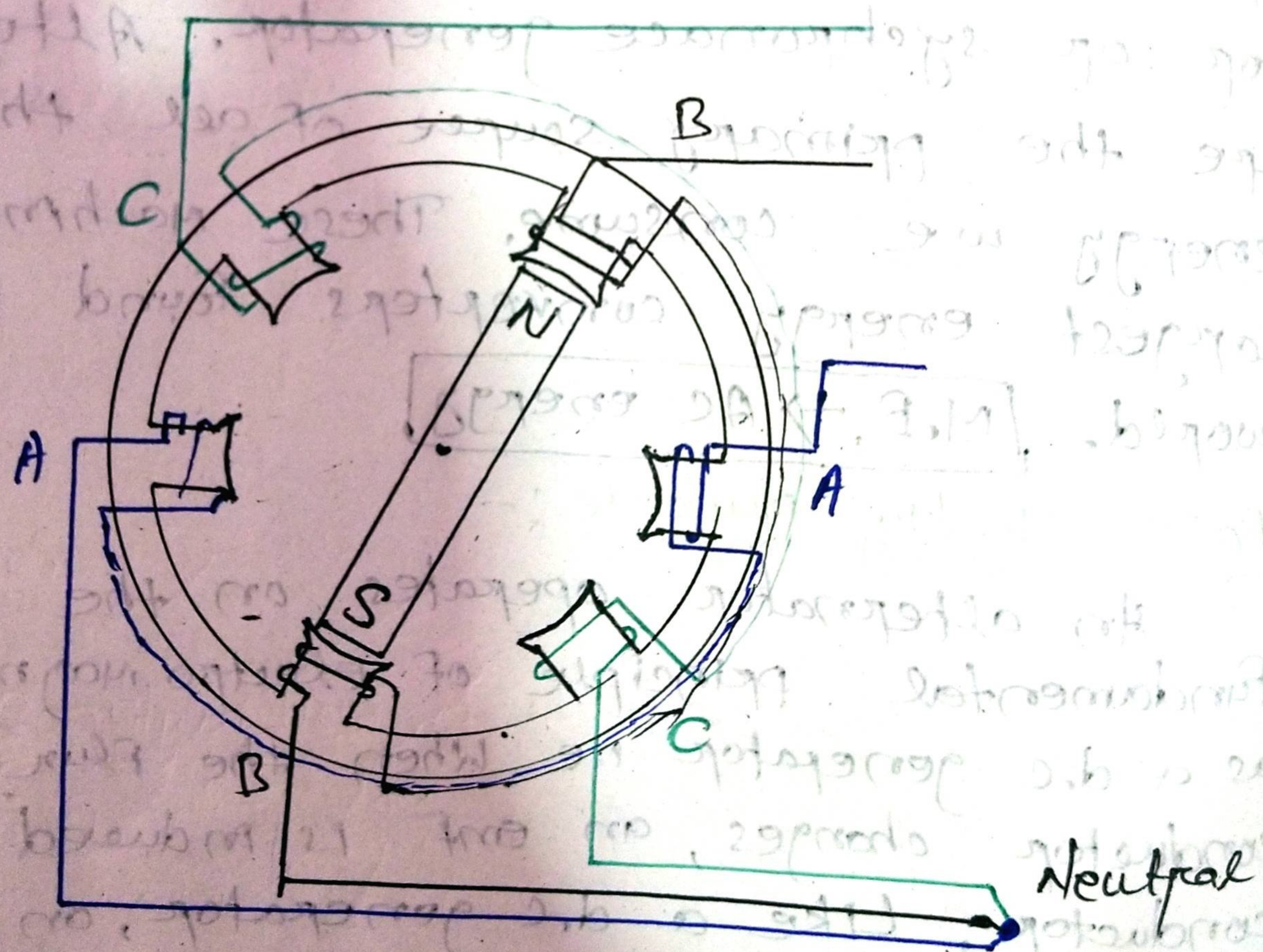
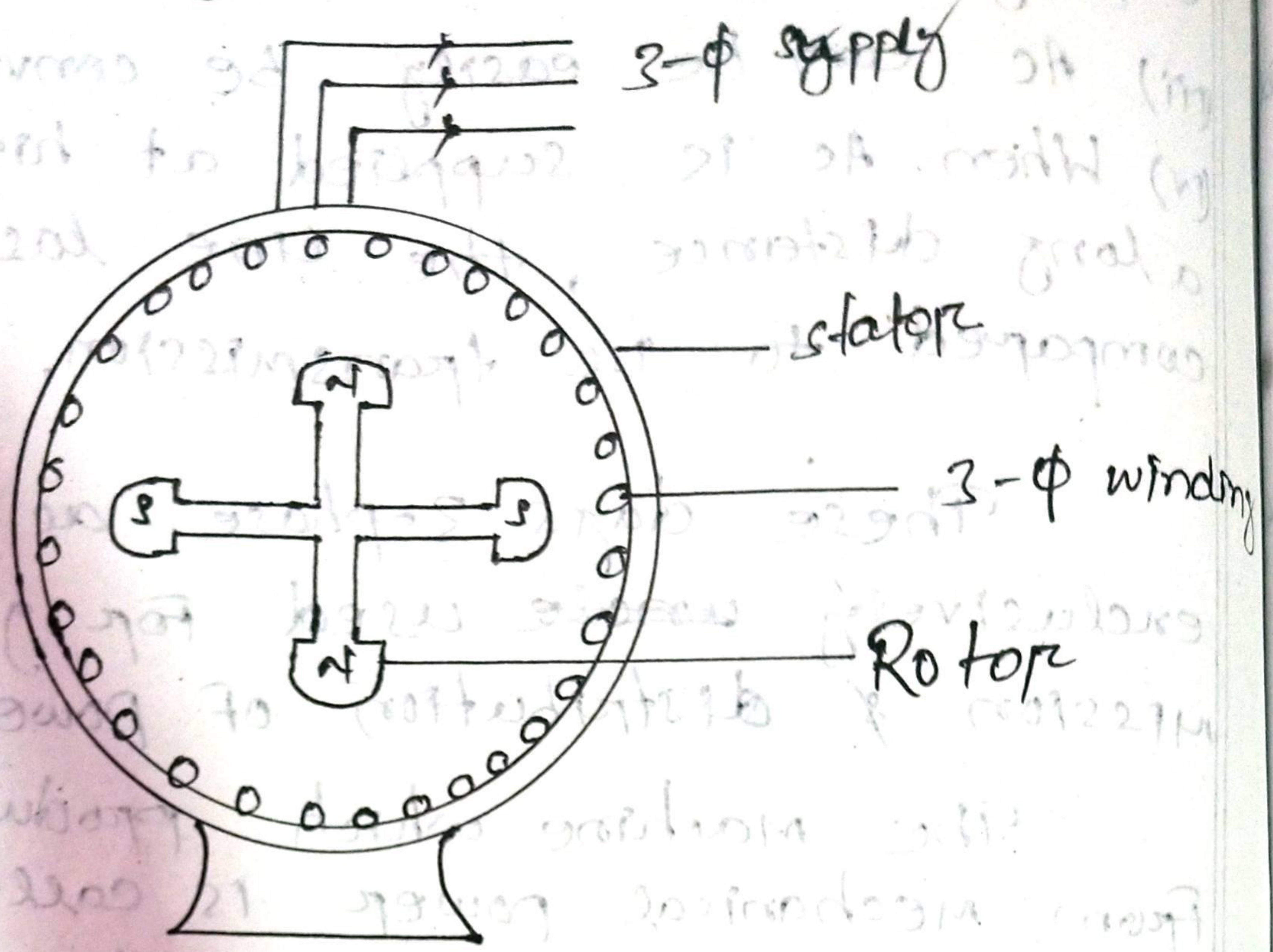
The machine which produce 3-phase power from mechanical power is called an alternator or synchronous generator.

Alternators are primary source of all the electrical energy we consume. These machines are the largest energy converters found in the world.

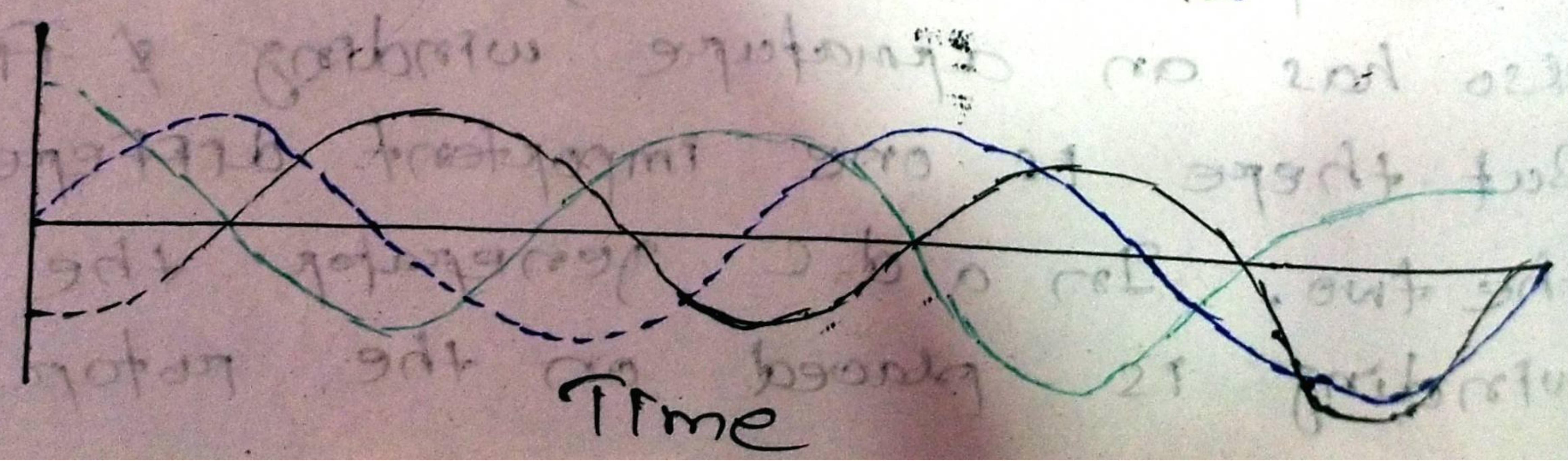
Basic Working Principle

An alternator operates on the same fundamental principle of electro magnetic induction as a dc generator i.e. when the flux linking a conductor changes, an emf is induced in the conductor. Like a dc generator, an alternator also has an armature winding & field winding but there is one important difference betⁿ the two.

In a dc generator the armature winding is placed on the rotor in order to provide a way of converting voltages generated on the winding to a direct voltage at the terminals through the use of rotating commutator. The field poles are placed on the stationary part of the machine. Since no commutator is required in the alternator. It is usually more convenient & advantageous to place the field winding on the rotating part & armature winding on the stationary part. The stator consists of a cast iron frame which supports the armature core, having slots on its inner periphery for housing the armature conductors.



Current of Emf



The rotor is like a flywheel having alternate N & S poles fixed to its outer rim. The magnetic poles are fixed to its outer rim. The magnetic poles are excited (or magnetised) from direct current supplied by a dc source at 125 to 600 volts. In most cases necessary exciting current is obtained from a small dc shunt generator which is belted or mounted on the shaft of the alternator itself. Because the field magnets are rotating this current is supplied through two sliprings.

As the exciting voltage is relatively small the slip rings & brush gear are of light constructions. Recently, brush less excitation system have been developed in which a 3-phase ac exciter & group of rectifiers supply dc to the alternator. Hence brushes, slip rings & commutator are eliminated.

When the rotor rotates, the stator conductors are cut by the magnetic flux hence they have induced emf produced in them. Because the magnetic

poles alternately N & S they induce an emf & hence current in armature conductors which first flows in one direction & then in the other.

Hence an alternating emf is produced in the stator conductors whose frequency depends on the no. of N & S poles moving past of conductor in one second & whose direction is given by Fleming's Right Hand Rule.

* Fleming's Right Hand Rule gives which direction the current flows. The right hand is held with the thumb, index finger & middle finger mutual perpendicular to each other (right angles). The thumb points in the direction of the motion of the conductor relative to the magnetic field.

Stationary Armature

The field winding of an alternator is placed on the rotor & is connected to dc supply through two slip rings. The 3-phase armature winding is placed on the stator.

This arrangement has the following advantages:

(i) The output current can be lead directly from fixed terminal on the stator (or armature winding) to the load circuit without having to pass it through brush contacts.

(ii) It is easier to insulate stationary armature winding for high ac voltages which may have as high value of 30 kV or more.

(iii) Only two slip rings are required for dc supply to the field winding on the rotor. Since the exciting current is small, the slip ring & brush gear required are of light constructions.

(iv) Due to simple construction at the rotor higher speed of rotating dc field is possible. This increases the output obtainable from a machine of given dimensions.

Construction of Alternator :-

An alternator has 3-phase winding on the stator & a dc field winding on the rotor.

(1) Stator :-

It is the stationary part of the machine. In dc machine, the outer frame (yoke) serves to carry the magnetic flux but in alternators, it is not meant for that purpose. Here it is used for holding the armature stampings & winding in positions. The armature core is supported by the stator & is built up of laminations of special magnetic iron or steel alloy. The core is laminated to minimise loss due to eddy currents. The laminations are stamped out in complete rings or in segments. The laminations are insulated from each other & have space between them for allowing the cooling air to pass through.