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EM-I Assignment - I

- Q1) State the necessity of starter and explain the working of three point starter with suitable diagram -

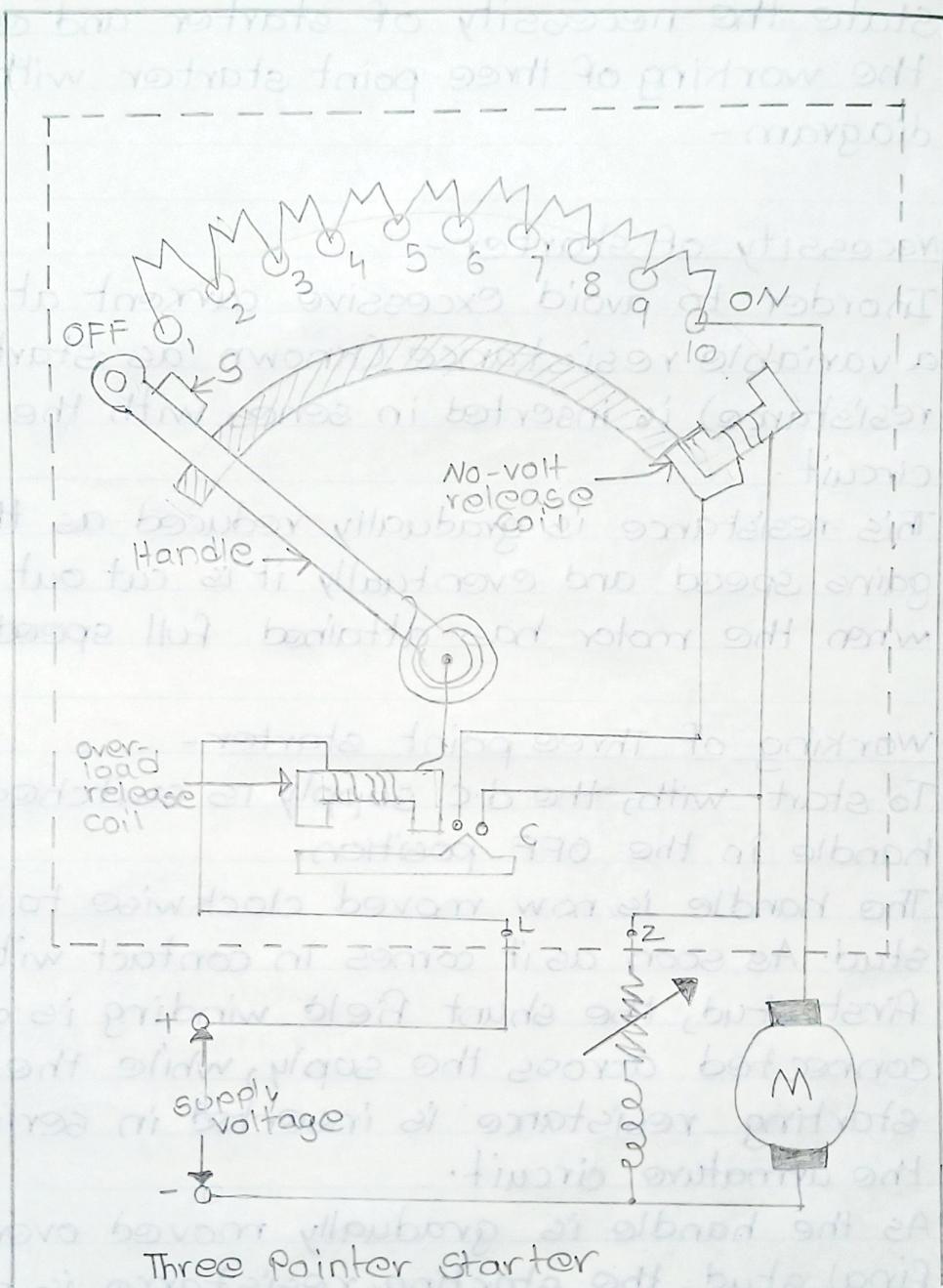
→ * Necessity of starter -

- ① Inorder to avoid excessive current at starting, a variable resistance (known as starting resistance) is inserted in series with the armature circuit.
- ② This resistance is gradually reduced as the motor gains speed and eventually it is cut out completely when the motor has attained full speed.

* Working of Three point starter -

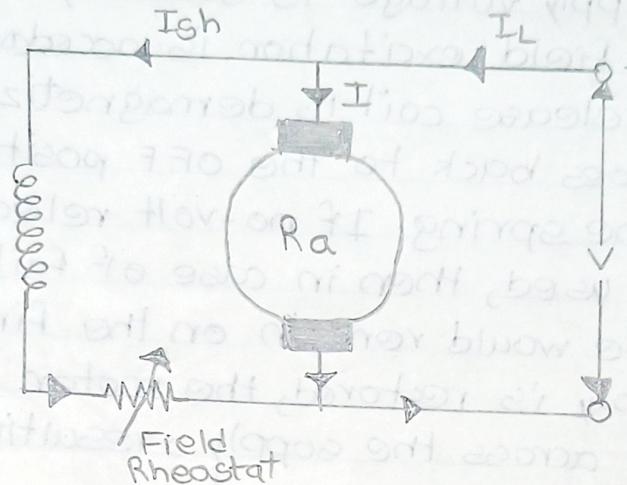
- ① To start with, the d.c supply is switched on with handle in the OFF position.
- ② The handle is now moved clockwise to the first stud. As soon as it comes in contact with the first stud, the shunt field winding is directly connected across the supply, while the whole starting resistance is inserted in series with the armature circuit.
- ③ As the handle is gradually moved over to the final stud, the starting resistance is cut out of the armature circuit in steps. The handle is now held magnetically by the no-volt release coil which is energized by shunt field current.

I - Form Three Phase I-M3

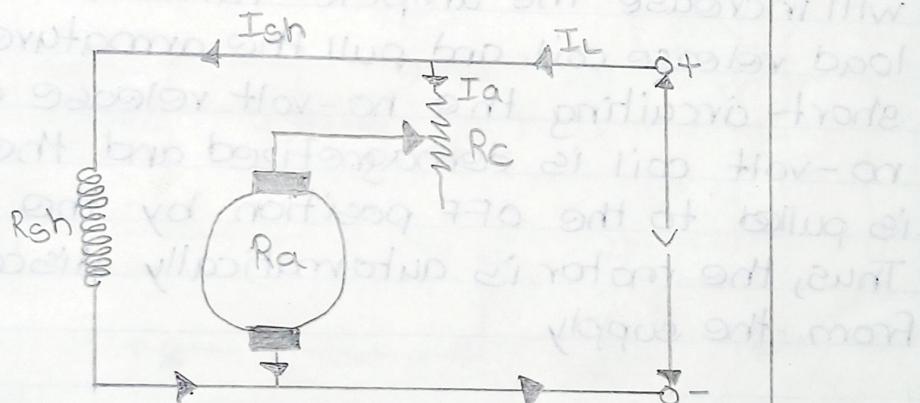


- ④ If the supply voltage is suddenly interrupted or if the field excitation is accidentally cut, the no-volt release coil is demagnetized and the handle goes back to the OFF position under the pull of the spring. If no-volt release coil were not used, then in case of failure of supply, the handle would remain on the final stud. If then supply is restored, the motor will be directly connected across the supply, resulting in an excessive armature current.
- ⑤ If the motor is over-loaded, it will draw excessive current from the supply. This current will increase the ampere-turns of the over-load release coil and pull the armature C, thus short-circuiting the no-volt release coil. The no-volt coil is demagnetized and the handle is pulled to the OFF position by the spring. Thus, the motor is automatically disconnected from the supply.

Flux Control Method (shunt)



Armature Control (shunt)



Q2) Explain various speed control methods for DC Motor.

→ * Speed control of D.C. Motors (Shunt)

① Flux Control Method

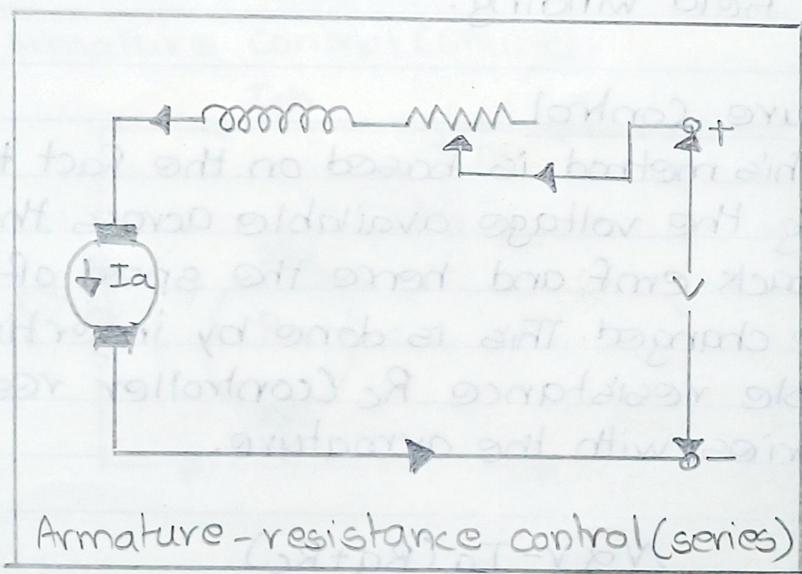
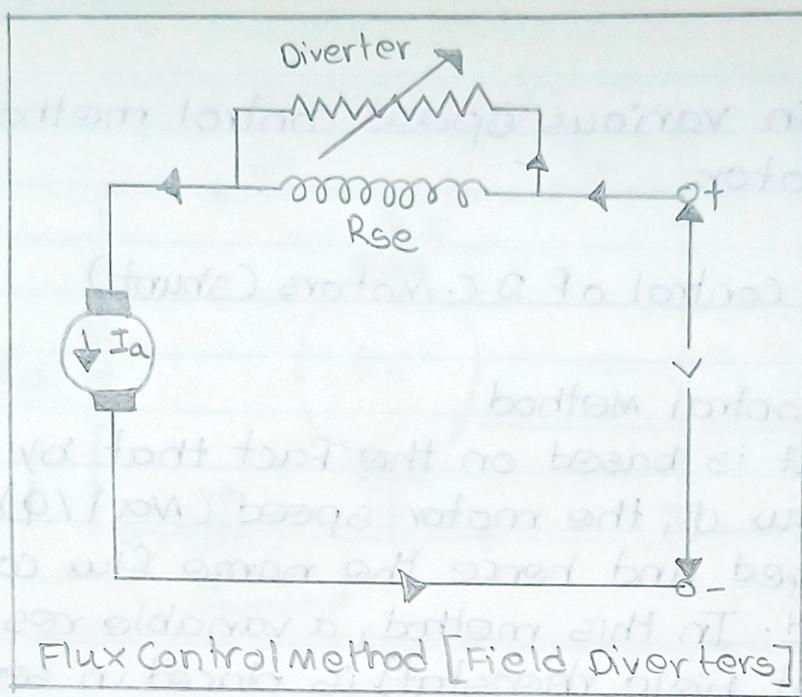
It is based on the fact that by varying the flux Φ , the motor speed (N_A / Φ) can be changed and hence the name flux control method. In this method, a variable resistance (shunt field rheostat) is placed in series with shunt field winding.

② Armature Control

This method is based on the fact that by varying the voltage available across the armature the back emf and hence the speed of the motor can be changed. This is done by inserting a variable resistance R_C (controller resistance) in series with the armature.

$$N_A \propto V - I_a (R_a + R_C)$$

where R_C = controller resistance.



③ Voltage control method.

In this method, the voltage source supplying field current is different from that which supplies the armature. This method avoids the disadvantages of poor speed regulation and low efficiency as in armature control method. However, it is quite expensive. Therefore method of speed control is employed for large size motors where efficiency is required.

* Speed control of D.C Series Motors

① Flux control Method.

In this method, the flux produced by the series motor is varied and hence the speed. The variation of flux can be achieved in the following ways:

- i) Field diverters
- ii) Armature diverters
- iii) Tapped field control
- iv) Paralleling field coils



② Armature - resistance control

In this method, a variable resistance is directly connected series with the supply to the complete motor. This reduces the voltage variable across the armature and hence the speed falls.

③ Draw & Explain the constructional diagram of DC machines.

→ ① Yoke -

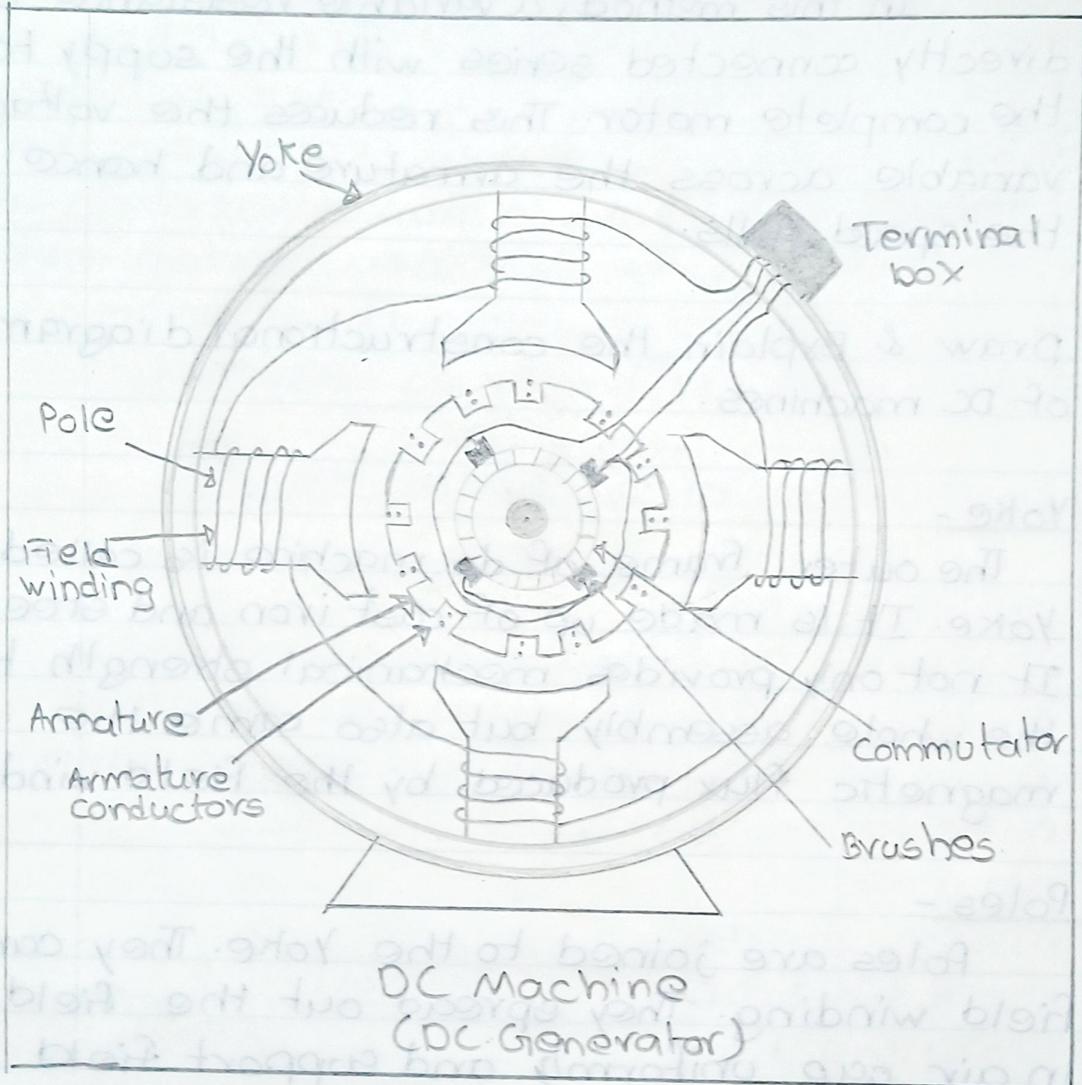
The outer frame of dc machine is called as yoke. It is made up of cast iron and steel. It not only provides mechanical strength to the whole assembly but also carries the magnetic flux produced by the field winding.

② Poles -

Poles are joined to the yoke. They carry field winding. They spread out the field in air gap uniformly and support field coils.

③ Field winding -

They are usually made of copper. Field coils are formed wound and placed on each pole and are connected in series.



DC Machine
(DC Generator)

④ Armature core -

Armature core is the rotor of dc Machine. The armature is built up of thin laminated circular steel disks for reducing oddy current losses. Armature is fixed to the shaft.

⑤ Armature winding -

It is usually a former wound copper coil which rests in armature slots. The armature windings can be wound by one of the two methods : lap winding or wave winding.

⑥ Commutator and brushes -

The function of a commutator, in a dc generator, is to collect the current generated in armature conductors whereas, in case of a dc motor, commutator keeps in providing current to the armature conductor.

Brushes are usually made from carbon or graphite. They rest on commutator segment and slide on the segments when the commutator rotates keeping the physical contact to or supplying the current.