2. **Self Excited DC Motor :** A DC Motor in which the field winding is connected as the output of motor itself is called **Self excited DC Motor.**

The Self excited DC Motor can be classified into: (i) DC Shunt Motor (ii) DC Series Motors (iii) DC Compound Motor.

(i) **DC Shunt Motor :** In which the field winding is connected in Parallel with the armature and DC supply.

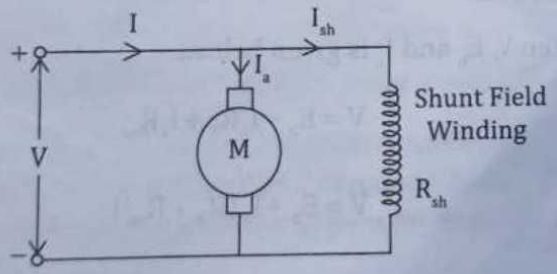


Fig 3.17(a) Schematic diagram of DC Shunt Motor

The Connection of diagram DC Shunt Motor as shown in Fig 3.17(a). In which the Field shunt current is independent of the armature current (I_a).

The input current $I = I_a + I_{sh}$

Where

I = Input current

I_a = Armature current

I_{sh} = Shunt field current

The relationship between V, E_b and I_a is given by

$$V = E_b + I_a R_a$$

Where

V = Supply voltage

E_b = Back emf

R_a = Armature resistance

I_a = Armature current

(ii) DC Series Motor

The field windings are connected in Series with armature. The series field winding carries input current. The Schematic diagram of DC Series Motor as shown in Fig 3.17(b).

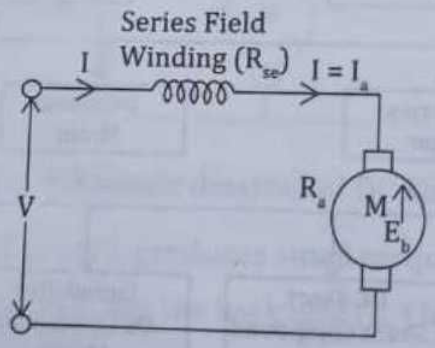


Fig 3.17(b) Schematic diagram of DC Series Motor

Where

V = Supply voltage

I = Input current

I_a = Armature current

R_{se} = Resistance of series field

R_a = Resistance of armature

E_b = Back emf induced

The relationship between V, E_b and I_a is given below.

$$V = E_b + I_a R_a + I_a R_{se}$$

$$V = E_b + I_a (R_a + R_{se})$$

(iii) DC Compound Motor

The DC Compound Motor which has two field winding: one connected Parallel with armature and other in Series with armature. The DC Compound Wound Motor can be classified into:

1. DC Short Shunt Compound Motor
2. DC Long Shunt Compound Motor

1. DC Short Shunt Compound Motor

The Connection of Series field winding and Shunt field winding with armature of the DC Short Shunt Compound Motor as shown in Fig.3.18(a). In Short Shunt Compound Motor, the shunt field winding is connected across armature and series field winding is connected in series.

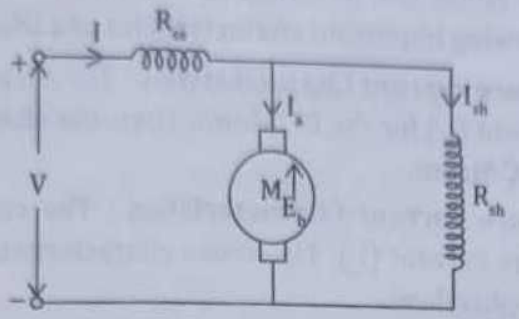


Fig 3.18(a) Schematic diagram of DC Short Shunt Compound Motor

The input current $I = I_a + I_{sh}$

$$V = E_a + I_a R_a + I R_{se} \quad (3.26)$$

2. DC Long Shunt Compound Motor

In **DC Compound Motor**, both series and shunt field windings are connected with the armature. The total excitation is due to both series and shunt field windings.

In **Long Shunt DC Compound Motor,** the series field winding is connected in series with armature and that continuation is connected in parallel winding. The Schematic diagram of **DC Long Shunt Compound Motor** as shown in Fig.3.18(b).

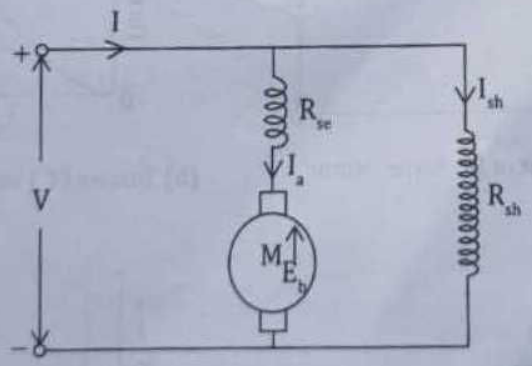


Fig 3.18(b) Schematic diagram of DC Long Shunt Compound Motor

In DC Compound Motor, both series and shunt field windings are connected with armature. The total excitation due to both series and shunt winding. In Long Shunt DC Compound Motor, the series winding is connected in series with armature and the combination is connected in parallel to shunt winding.

The relationship between V, E_b and I_a is given below.

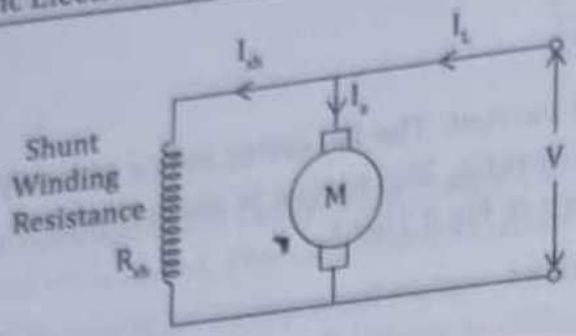
2. Characteristics of DC Shunt Motor

The Connections of DC Shunt Motor as shown in Fig.3.20. In which the Shunt field current (I_{sh}) is constant and the field winding is directly connected to the supply voltage. In DC Shunt Motor, the flux in DC Shunt Motor is approximately constant

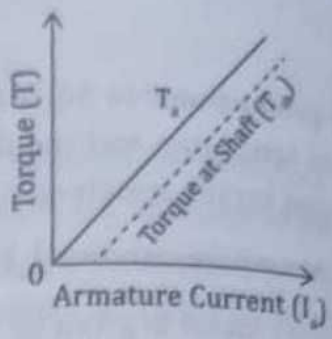
(i) Torque (T) versus Armature current (I_a) Characteristics

The Torque equation of a DC Motor is given by

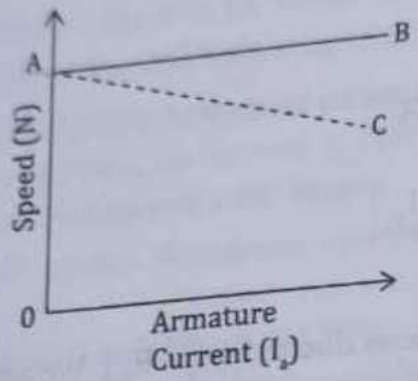
$$T = 0.0162\varphi Z I_a P/A \qquad (3.32)$$



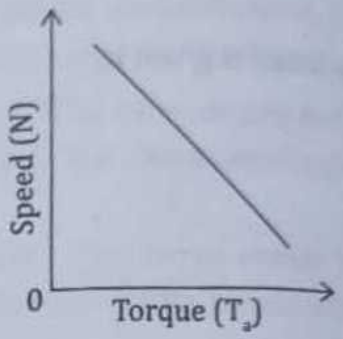
(a) Circuit of DC Shunt Motor



(b) Torque (T_a) versus Armature Current (I_a)



(c) Speed (N) versus Armature Current (I_a)



(d) Speed (N) versus Torque (T_a)

Fig 3.20 DC Shunt Motor and its Characteristics Curve

Where

Z, P, A = Constants for particular motor

From that $T \alpha \varphi I_a$

Similarly, the Torque (T) versus Armature current (I_a) Characteristics for Series DC Compound Motor, DC Compound Motor, Differentially DC Compound Motor and Cumulatively DC Compound Motor as shown Fig 3.21(d).