ECE132: Basic Electrical and Electronics Engineering Lab
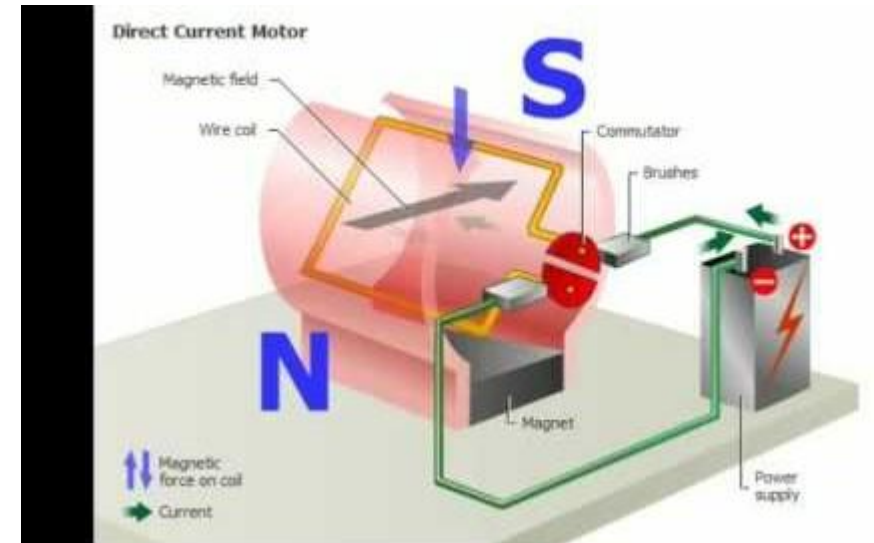
Experiment 7:

To understand principle of speed control of a DC motor Proteus software.

Introduction to DC Motor

- A motor is an electrical machine which converts electrical energy into mechanical energy. The principle of working of a DC motor is that "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". The direction of this force is given by Fleming's left hand rule and it's magnitude is given by $F = BIL$. Where, B = magnetic flux density, I = current and L = length of the conductor within the magnetic field.

Direct Current Motor

Magnetic field

Wire coil

Commutator

Brushes

S

N

Magnet

Magnetic force on coil

Current

Power supply

Introduction to DC Motor

- Back Emf: When the armature of the motor is rotating, the conductors are also cutting the magnetic flux lines and hence according to the Faraday's law of electromagnetic induction, an emf induces in the armature conductors. The direction of this induced emf is such that it opposes the armature current (I_a) .

- With increasing back emf armature current will start decreasing. Torque being proportional to the armature current, it will also decrease until it becomes sufficient for the load. Thus, speed of the motor will regulate.

- On the other hand, if a dc motor is suddenly loaded, the load will cause decrease in the speed. Due to decrease in speed, back emf will also decrease allowing more armature current. Increased armature current will increase the torque to satisfy the load requirement. Hence, presence of the back emf makes a dc motor 'self-regulating'.
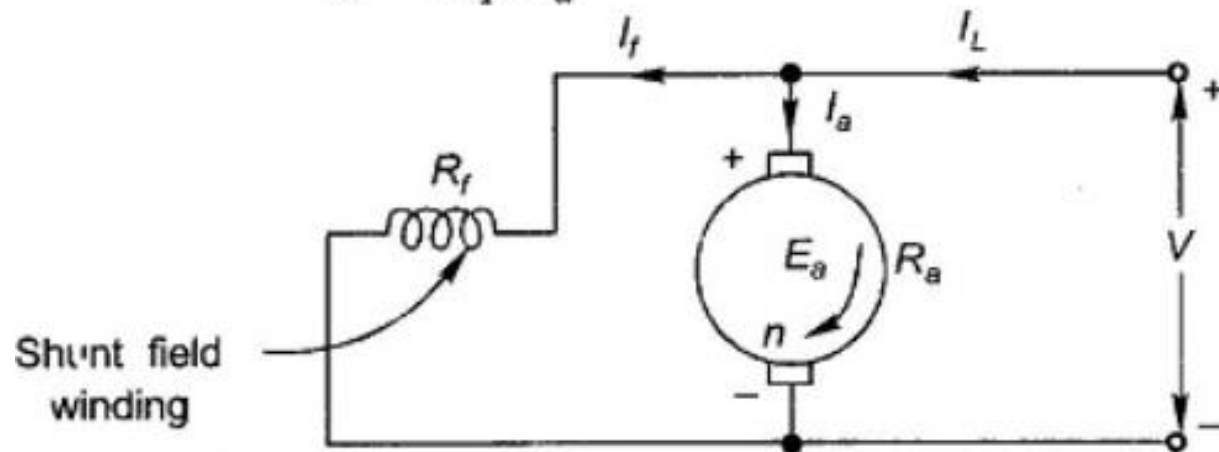
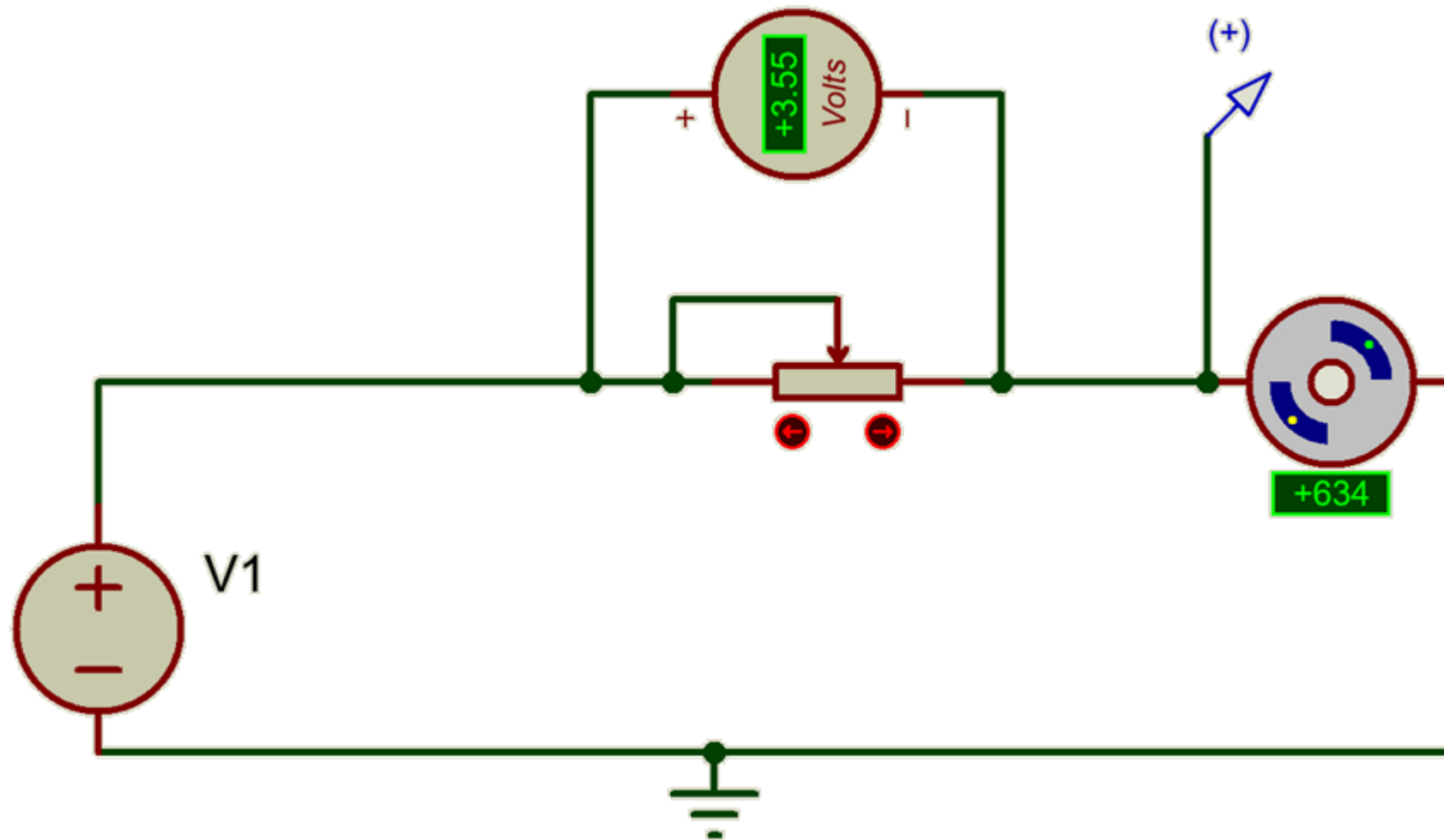# Introduction to DC Motor

Modelling Equation

$$E_a = V - l_a R_a$$

$$n = K_N \left(\frac{V - I_a R_a}{\Phi} \right)$$

$$T = K_T \Phi I_a$$

Simulation

Observation and Calculation

S.No	Vs (in Volts)	Ia (in Amp)	N (RPM)	T (%age)

From Roll No 1 to 9:
Plot a graph between Vs and N

From Roll to 10 to 18:
Plot a graph between I and T