Speed Control of DC Motor

1 Aim of the Experiment

To control the speed of a DC motor.
1. by varying field current with armature voltage kept constant (field control).
2. by varying armature voltage with field current kept constant (armature voltage con- trol).

2 Background

The speed of a DC shunt motor is given by the relation

$$\text{N}=K(V - I_a R_a)/\phi \text{ rpm}$$

where,

$$\begin{gathered}\text{V} = \text{applied voltage (volt)} \\ I_a = \text{current in armature (amp)} \\ R_a = \text{armature resistance (ohm)}\end{gathered}$$

$\phi = fieldflux(webers/pole)$ 1
Constant K for the given motor is given by

$$\text{K}=\text{ZP}/60\text{a}$$

where,

$$\begin{gathered}\text{Z} = \text{No.of armature conductors} \\ \text{P} = \text{No.of poles} \\ \text{a} = \text{No.of parallel paths}\end{gathered}$$

From the relation of speed as above, the speed of the DC shunt motor can be varied by varying
1. Voltage applied to armature
2. Armature resistance Ra
3. The flux
In this experiment, speed control is attempted by armature voltage control by adding a series resistance. The field voltage is controlled to vary the flux per pole.
All the four machines are engaged in this experiment for the purpose of measuring the speed.

S.No.	Armature Voltage	Speed

Table 1: Observation Table 1

3 Procedure

3.1 Field control method

1. Connect the circuit diagram as shown in fig.1.
2. The field and the armature resistance should be kept in the minimum and maximum positions respectively.
3. Switch on the EM clutch and keep the field of the DC Gen at some fixed value below the rated value.
4. Switch ON the supply and reduce the armature resistance to run the motor at rated speed.
5. Measure the voltage across the DC Gen at rated speed and calibrate this voltage to speed.
6. Change the speed by varying the field rheostat in steps and note down the correspond- ing values of speed and field current.
7. Make sure the speed does NOT increase beyond 1700 rpm.
8. Plot Field current Vs Speed graph.

3.2 Armature control method

1. Connect the circuit diagram as shown in fig.1.
2. The field and the armature resistance should be kept in the minimum and maximum positions respectively.
3. Switch on the EM clutch and keep the field of the DC Gen at some fixed value below the rated value.
4. Switch ON the supply and reduce the armature resistance to run the motor at rated speed.
5. Measure the voltage across the DC Gen at rated speed and calibrate this voltage to speed.
6. Change the speed by varying the armature rheostat in steps and note down the correspond- ing values of speed and field current.
7. Plot Field current Vs Speed graph.

S.No.	Field Current	Speed

Table 2: Observation Table 2

4 Report

1. In an A4 sheet of paper, write your name and roll number, and also the name of the experiment.
2. Include the data from the excel sheet where the experimental data is stored.
3. Include the relevant plots.