BRAC UNIVERSITY

BSRM School of Engineering

Department of Electrical and Electronic Engineering

Lab Report

Fall 2025

Course Code: **EEE221L**

Course Title: Energy Conversion I Laboratory

Lab Section: 03

Experiment No.: 06

Name of the experiment: Speed control to DC Shunt Motor.

Date of Submission: 05/11/2025

Group No: 03

Group Member Details:

1. *Name:* Souvik Barman Ratul
   I.D. 24121205
2. *Name:* Rafsan wazed.
   I.D. 24121202
3. *Name:* Abul Azmain Afik
   I.D. 24121200.
4. *Name:* Moobtasim Tajwan.
   I.D. 24121190
5. *Name:* Devaroti sankar.
   I.D. 24121196

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Submitted by

Name: Souvik Barman Ratul.

ID: 24121205

Submitted To

Faculty Name:

Subhan zawad Bihan.

Object: The goal of the experiment is to study different methods of speed control of a DC Shunt motor and to observe how armature voltage and field current affect the motor speed.

Apparatus:

1] Power supply unit.
2] DC Motor.
3] DC voltmeter.
4] DC Ammeter.
5] Tachometer.

Theory

The speed of a DC Shunt motor is given by this equation.

$$N = \frac{K(V - I_a R_a)}{\phi} \text{ r.p.m.} \quad \ldots (i)$$

from (i), we can see that,

- speed increased when armature voltage increased.
- Speed decreased when field current increases (Field control method)

V = applied terminal voltage.
I_a = armature current.
R_a = armature resistance
ϕ = field flux
K = Machine constant

Therefore, there are main two method of controlling the speed of a DC shunt motor.

1) Armature voltage control Method:-

The field current is kept constant. The armature voltage is varied to change the speed.

2) Field flux control Method:

The aramature voltage is kept constant. The field current is varied to change the flux. used for speed. above the rated value.

Circuit Diagram:

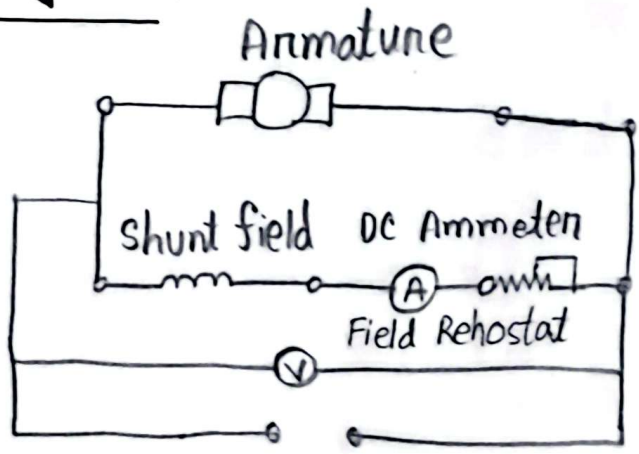

Figure-1

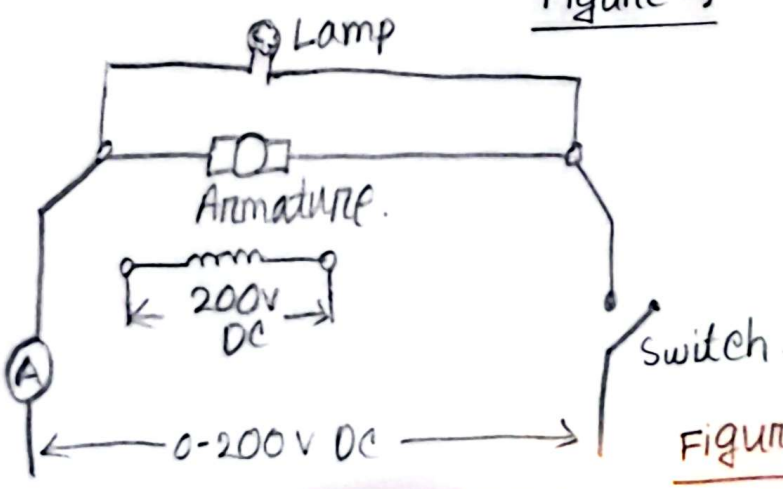

Figure-2

rocedure

[Flux control Method]

1] Connect the ckt. shown in figure-1,

2] Keep the field Rheostat control knob at minimum position for minimum resistance.

3] Turn on the power supply.

4] gradually increase the voltage up to motor related voltage.

5] record the motor speed and field current by varying field rheostat

6] take data by varying field rheostat.

7] return the field Rheostat control knob at its previous position gradually.

8] return the voltage zero and turn off the power supply.

[Voltage control method]

9] Gradually increase DC voltage up to motor rated voltage. now measure and record the data.

10] return the voltage to zero and turn on the power supply.

[Armature current control method]

11] connect the ckt. shown in Figure-2

12] Turn on ~~voltage~~ Power supply, gradully increase arature Voltage up to motor rated voltage.

13] Measure and record the data (I_a Vs motor speed]

14] open the switch and observe the happend.

15] Return the voltage to zero and turn off the power supply.

Sl. No.	I_f (A)	Speed (rpm)
1	0.477	1435
2	0.469	1457
3	0.463	1469
4	0.456	1482
5	0.449	1495
6	0.441	1496

Voltage Control Method:

9) Gradually increase DC voltage up to motor rated voltage. Measure and record 5 sets of data (speed vs voltage)

Sl. No.	Voltage (V)	Speed (rpm)
1	30.9	550
2	50.7	774
3	79.7	900
4	118.8	1046
5	~~150~~ 151	1193
6	181	1337
7	200.4	1435

10) Return the voltage to zero and turn on the power supply.

Armature current control method:

11) Connect the Ckt. Shown in Figure - 2.
12) Turn on the power supply, gradually increase armature voltage up to motor rated voltage.
13) Measure and record 5 sets of data (Armature current Ia vs motor speed).

$R_A = 29.3\Omega$

Sl. No.	~~R_f + R_A + R_H~~ Armature ~~current I_a~~ (A)	Motor speed (rpm)
1	29.3	1440
2	~~14~~ 59.3	1355
3	89.3	1314
4	119.3	1260
5	149.3	1225
6	179.3	1186

14) Open the switch and observe what happened.
15) Return the voltage to zero and turn off the power supply.

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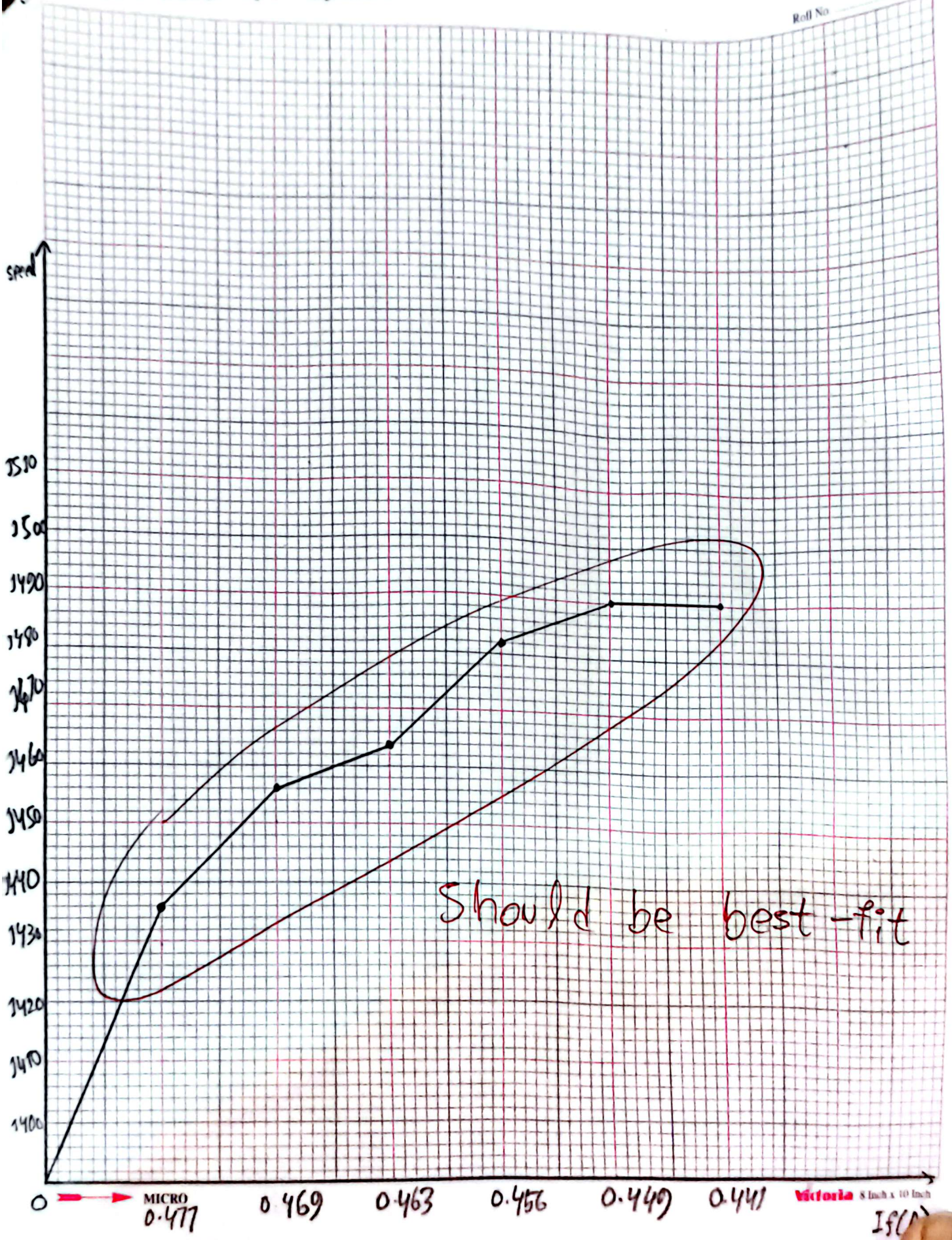
Faculty Signature and Date

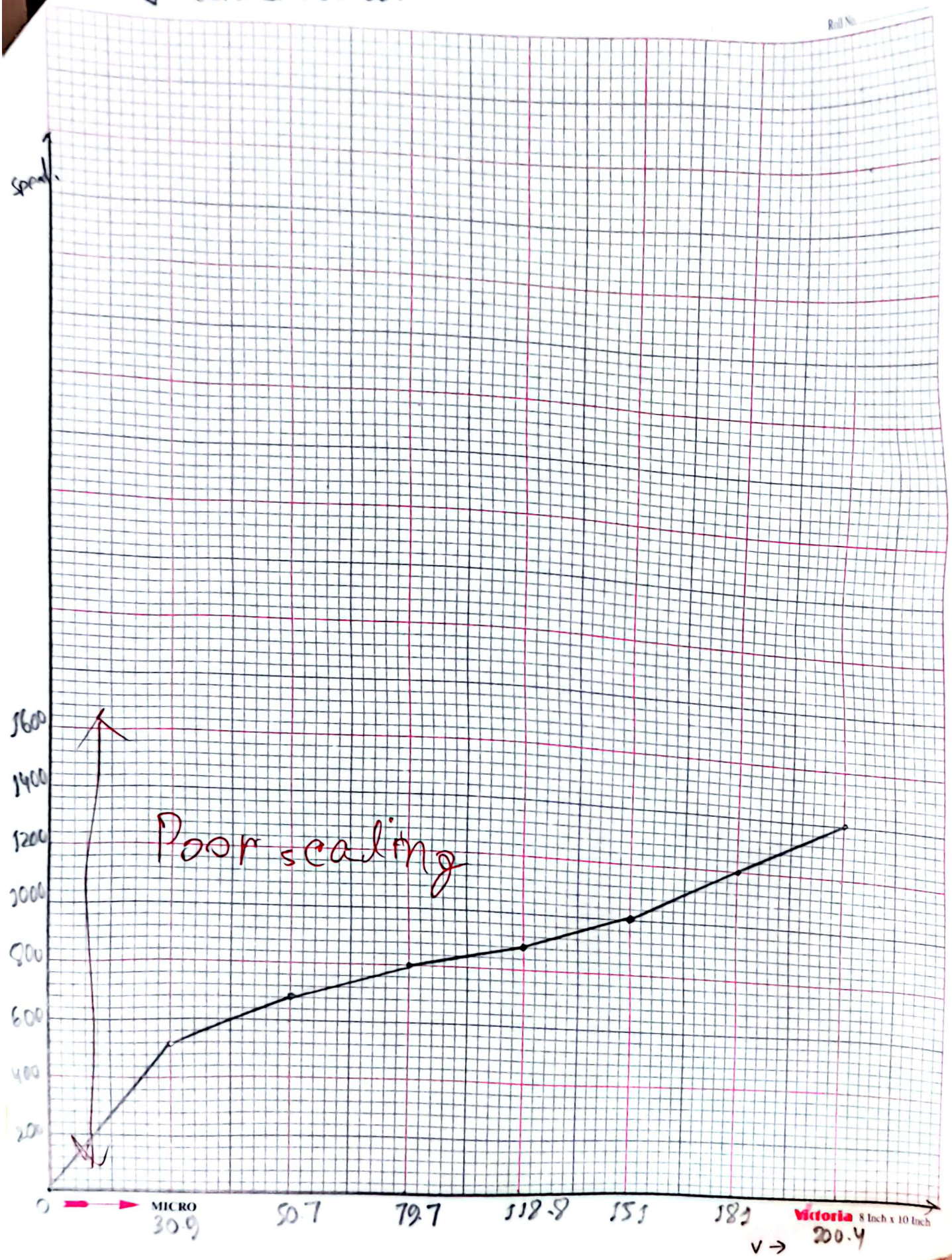
6. Report & Question:

1. Plot N vs I_f, N vs I_a and N vs Voltage curve on the graph paper.
2. Comment on the merits and demerits of various methods of speed control of a DC shunt motor.
3. How do you proof of the existence of back emf from the procedure 14?

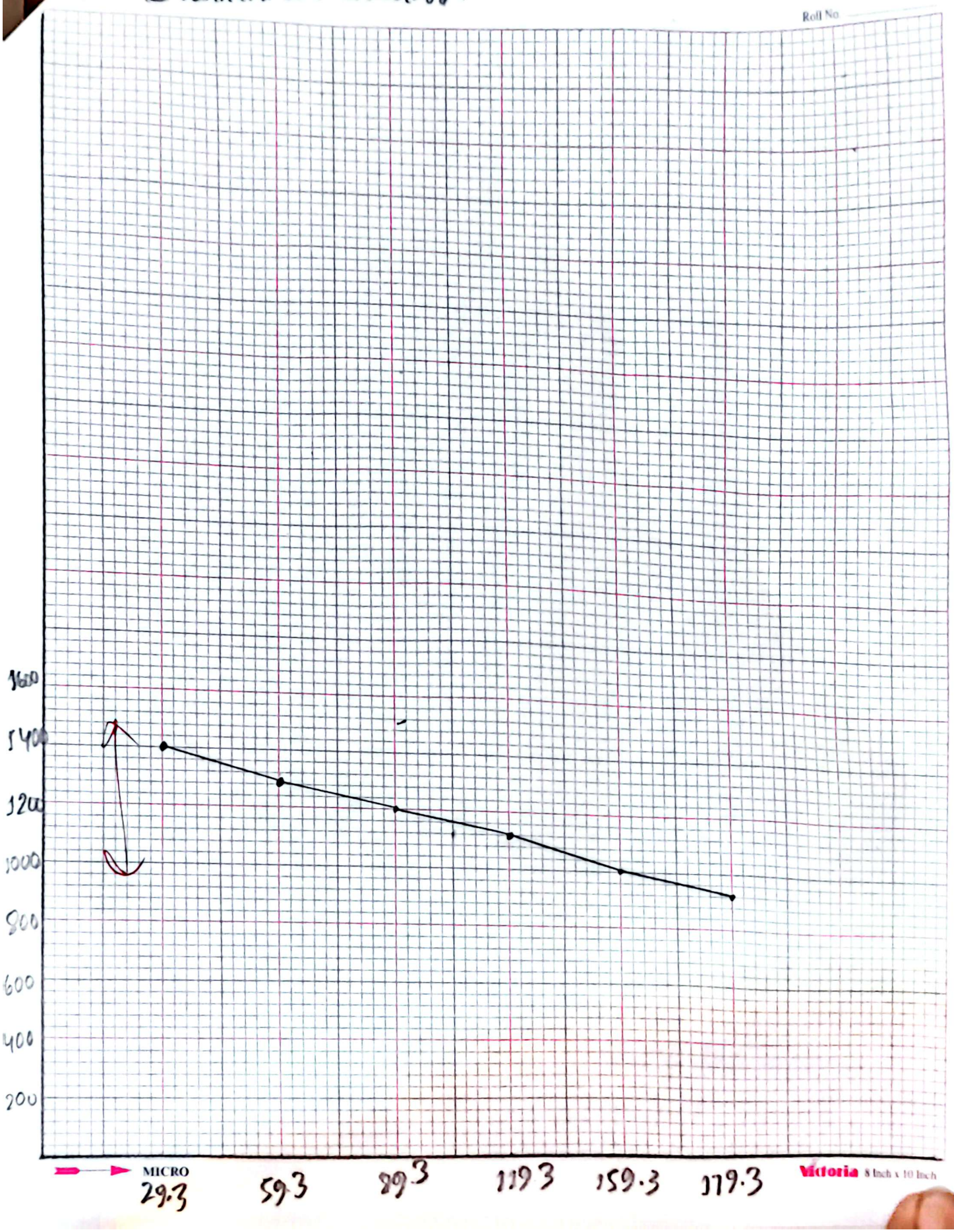
Flux control method.



voltage control method.



Armature current control Method.



Results discussion

From the experiment data and graphs. in the field control test, the motor speed increased from about 1420 to 1680 rpm as the field current decreased from 0.6 to 0.3A it showing that weaker field flux increases speed($N \propto \frac{1}{\phi}$) for Armature voltage control test. the speed rose almost linearly from 800 to 1500rpm. and the voltage increased from 120V to 220V. And for Armature current control test, the speed dropped from 1500 to 1250 rpm as the armature current increased from 1A to 3A, for the larger voltage drop across the armature resistance.

Answers to the Question

2) The field control ~~is~~ method is simple and economical, allowing speed to increase above the rated value by reducing the field current, but it gives low speed regulation at light loads. The armature voltage control method, smooth speed variation below the rated speed with good control accuracy, though it requires a variable voltage supply. The armature current control method is mainly used to study the motor's torque speed characterstics. but it is not suitable for continious operation because high current causes heating and losses.

3] The existence of back EMF is proven by the relationship between voltage, current and ~~vol~~ speed. As voltage changes, the change in speed ~~dem~~ means that an opponing ~~so~~ voltage is generated,

$$V = E_b + I_a R_a.$$

The gradual increase in speed with voltage and its decrease with increasing current directly indicate that back EMF is present and proportional to speed.