IARE
INSTITUTE OF
AERONAUTICAL ENGINEERING
(An Autonomous Institute affiliated to JNTUH, Hyderabad)
Dundigal, Hyderabad - 500 043

LABORATORY WORK SHEET

Name of the Student: MADKI SAI CHARAN

Class: CSM-C Semester: Ist

Course Code: AEE003 Course Name: Electrical and electronics Engineering laboratory.

Roll Number									
2	3	9	5	1	A	6	6	F	2

Name of the Course Faculty: MS M. VARALAKSHMI Faculty ID: IARE 11072

Exercise Number: 08 Week Number: 08 Date: 29 December 2023

DAY TO DAY EVALUATION:

Marks	Aim / Preparation	Algorithm / Procedure Performance in the Lab	Source Code Calculations and Graphs	Program Execution Results and Error Analysis	Viva - Voce	Total
Max. Marks	4	4	4	4	4	20
Obtained	4	4	4	4	4	20

Signature of Faculty

START WRITING FROM HERE :

SWIMBURNE'S TEST ON DC SHUNT MOTOR.

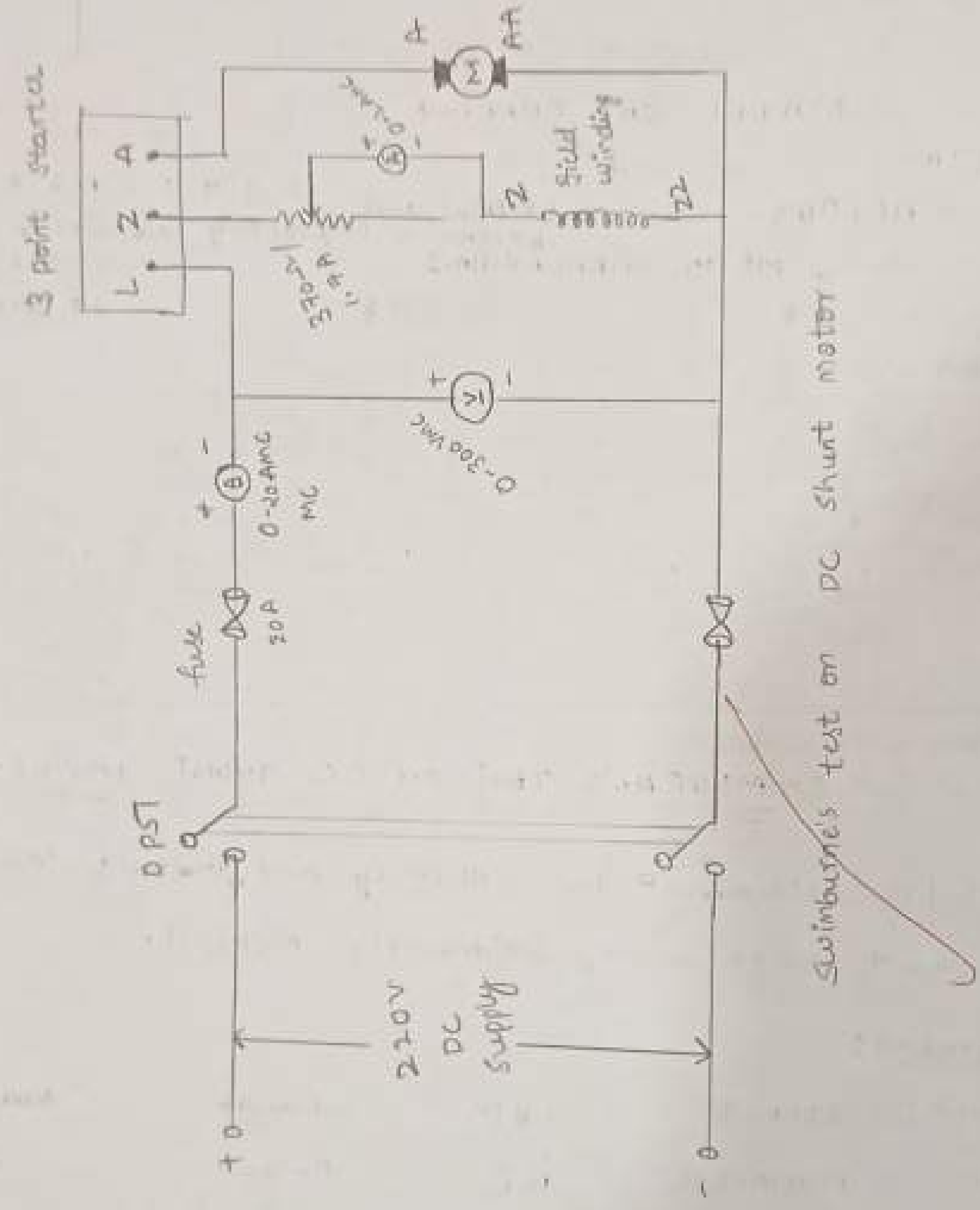
Aim: Pre determine the efficiency and constant losses of a DC shunt machine by Swinburne's method.

Apparatus:

S.NO	Items	Type	Range	Quantity.
1.	Ammeter	MC	0-20A	1
2.	Voltmeter	MC	0-300V	1
3.	Ammeter	MC	0-2A	1
4.	Rheostat	wire wound	370Ω/ 1.7A	1
5.	Connecting wires	—	—	—

ROLL NUMBER : 2395IA66F2

Circuit diagram:



ROLL NUMBER: 23951A66F2

Name plate details:

Motor	
voltage	230V
current	19A
output	5 HP
Speed	1500 rpm

Procedure: ① choose the proper ranges of meters after noting the name plate details of the given machine and make the connections as per the circuit diagram.

② Keep the motor field rheostat (R_f) in the minimum start the motor by closing the switch and operating the starter slowly.

③ Run the motor at rated speed by adjusting the motor field rheostat.

④ Note down the voltages no load current and field current Calculation for swinburn's test:-

from the no load test results

Supply voltages = V_L volts.

No load line current = I_L Amperes.

Field current = I_f Amperes.

Therefore No load armature currents = $I_{a0} = I_L - I_f$ Amperes.

armature resistance = R_a ; R_a = 1.25 ohms

no load copper losses are = $I_{a0}^2 R_a$.

No load power input = $V_L I_L$.

constant losses = (No load Power input - No load copper losses).

ROLL NUMBER: 23951A66F2

Tabular Column:

S.NO	V (volt)	I_{L0} (A)	I_f (A)	Speed (rpm)
1	230	1.4	0.7	1500

$P = 1.25\Omega$

As a motor Rated voltage $V_L = 230V$

S.NO	Voltage (V)	I_L (A)	I_f (A)	Input power (P_i) $V_L \times I_L$ watt	Constant losses W_{const} watt	Copper losses $W_{cu} = I_a^2 R_a$ (W)	Total losses ($W_{const} + W_{cu}$) (W)	O/P power (I/P Total losses) (W)	$\eta\%$ $\frac{P_o}{P_i} \times 100$
01	230	1.4	0.7	322	321.4	0.61	322	0	0
02	230	2	0.7	460	321.4	2.11	323.51	136.49	29.67
03	230	4	0.7	920	321.4	13.61	335.01	584.39	63.3
04	230	5	0.7	1150	321.4	23.11	344.51	805.44	70.04
05	230	7	0.7	1610	321.4	49.61	371.01	1238.5	76.92

As a generator rated voltage $V_L = 230V$.

S.NO	Voltage (V)	I_L (A)	I_f (A)	output power ($V_L I_L$)	constant losses, W_{const}	copper losses $W_{cu} = I_a^2 R_a$	Total losses ($W_{const} + W_{cu}$)	Input power (output power losses)	η
1	230	1.4	0.7	322	321.4	5.51	346.91	648.91	49.6
2	230	2	0.7	460	321.4	9.11	330.51	790.51	58.19
3	230	4	0.7	920	321.4	27.61	349.01	1269.01	72.49
4	230	5	0.7	1150	321.4	40.61	362.01	1512.01	76.05
5	230	7	0.7	1610	321.4	74.11	395.51	2005.51	80.3

Efficiency as motor:

Efficiency = output/input = (input - total losses)/input.

Where; total losses = constant losses + variable losses

constant losses are known value from the equation. ①

Variable loss = $I_a^2 R_a$ where $I_a = I_L - I_f$.

ROLL NUMBER : 2395IA66F2

Input = $V_L I_L$; V_L is rated voltage of the machine. Assume line currents (I_L) as 2, 4, 6, --- 20A and find corresponding efficiency.

Efficiency as Generator:

Efficiency = output/input = output/(output total losses)

where losses = constant losses + variable losses.

* constant losses are same for both motor and generator.

Armature current, $I_a = I_L + I_f$.

Variable loss = $I_a^2 R_a$.

Output power = $V_L I_L$, V_L is rated voltage of the machine. Assume load current (I_L) as 2, 4, 6, ---, 20A and find efficiencies.

Calculations: $V_{in} = 230V$; $I_{L0} = 1.4$; $I_f = 0.7$; Speed = 1500 rpm

No-load Input = $V_{in} I_{L0} = 230 \times 1.4$

$= 322 W$

$I_a = I_L - I_f = 1.4 - 0.7 = 0.7$

$R_a = 1.25 \Omega$

Variable losses = $I_a^2 R_a = (0.7)^2 \times 1.25 = 0.61$

No-load input = constant losses + variable losses (cu)

$W_C = V_{in} I_{L0} - I_{a0}^2 R_a$

$W_C = 322 - 0.6$

$W_C = 321.4$

ROLL NUMBER: 2395 1A66F2.

Rated current = 11A ; Assuming $I_L = 1.4$ $V = 230$; I_L = con

$I_f = (0.7)A$

$I_a = I_L - I_f = 1.4 - 0.7 = 0.7A$.

Total input = $VI_L = 230 \times 1.4 = 322A$

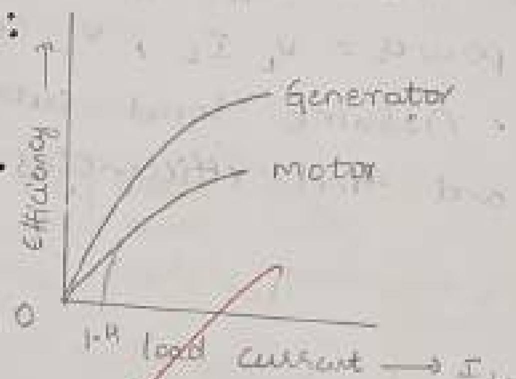
$W_c = 321.4W$

Copper losses = $I_a^2 R_{a} = 0.7^2 \times 1.25 = 0.61$

$$\eta = \frac{\text{output}}{\text{Input}} = \frac{\text{Input losses}}{\text{Input}} = \frac{VI_L - [W_c + I_a^2 R_a]}{VI_L}.$$

$$\Rightarrow \frac{321 - 322}{322} = 0\%$$

Model graph:



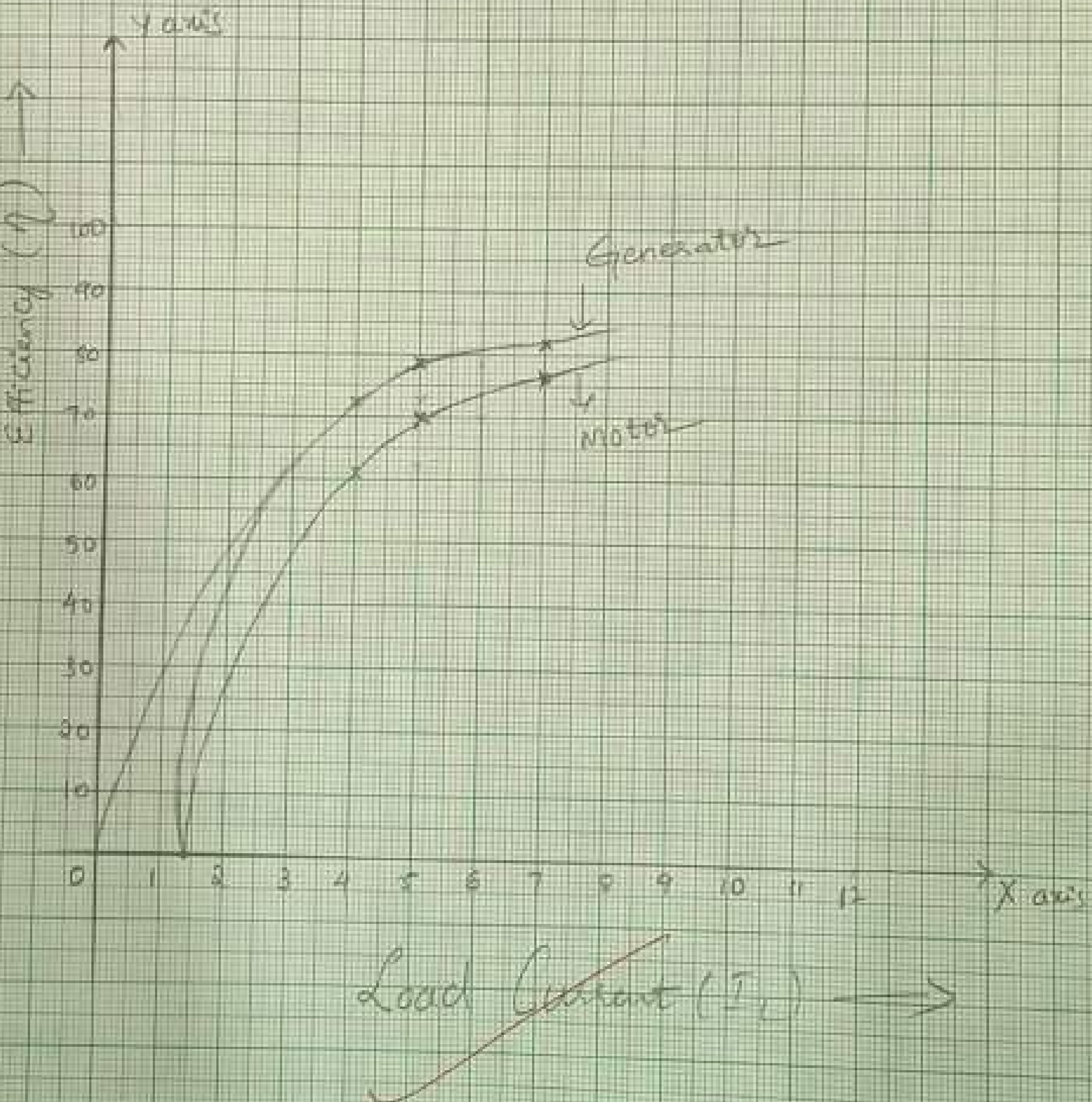
Precautions: ① Run the motor at rated speed and rated voltage.

② Avoid loose connections and parallax errors.

Result: Hence, verified the efficiency and constant losses of DC shunt machine by Swinburne's test.

Swinburne's Test on DC Shunt Motor.

Scale:
On x-axis 1 unit = 1
On Y-axis 1 unit = 10



IARE
INSTITUTE OF
AERONAUTICAL ENGINEERING
(An Autonomous Institute affiliated to JNTUH, Hyderabad)
Dundigal, Hyderabad - 500 043

LABORATORY WORK SHEET

Name of the Student ....

Roll Number									
2	3	9	5	1	A	6	6	F	2

Class .... Semester ....

Course Code .... Course Name ....

Name of the Course Faculty .... Faculty ID : ....

Exercise Number 08 Week Number 08 Date 29 December 2023

DAY TO DAY EVALUATION:

Marks	Aim / Preparation	Algorithm / Procedure Performance in the Lab	Source Code Calculations and Graphs	Program Execution Results and Error Analysis	Viva - Voce	Total
Max. Marks	4	4	4	4	4	20
Obtained						

Signature of Faculty

START WRITING FROM HERE :

Speed control of a DC shunt motor:

Aim : To vary the speed of the given dc shunt motor by armature control and field control methods and to pre-determine the efficiency of a DC shunt motor by Swim burne's (Test) method.

Name plate details :

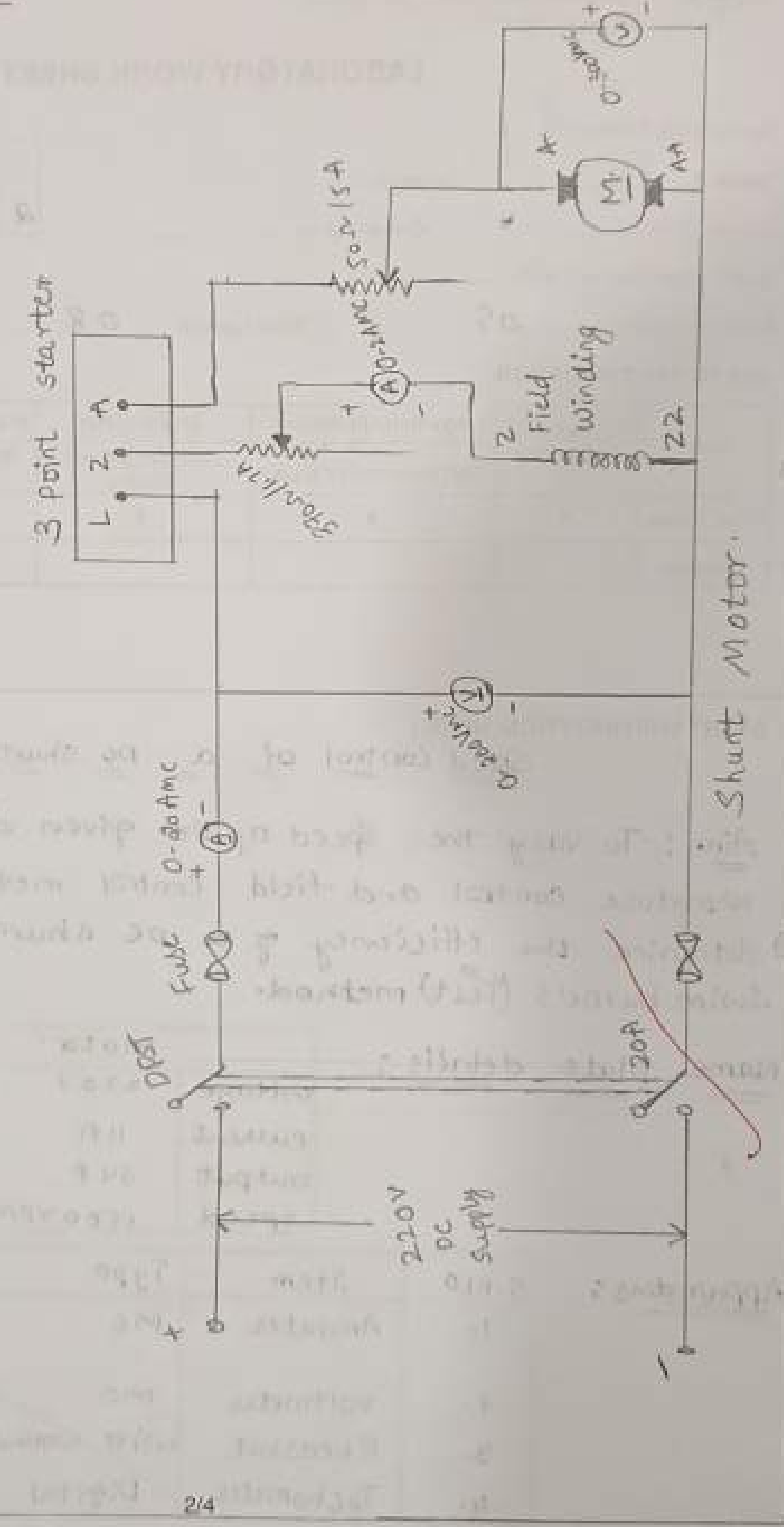
	Motor
voltage	220V
current	11A
output	3HP
speed	1500 rpm

Apparatus :

S.No	Item	Type	Range	Quantity
1.	Ammeter	MC	0-2A 0-20A	1
2.	voltmeter	MC	0-300V	1
3.	Rheostat	wire wound	370Ω/1.7A	1
4.	Tachometer	Digital	–	–

ROLL NUMBER: 23951A66F2.

Circuit diagram:



ROLL NUMBER : 2395lA66F2

Procedure of Speed Control:

Part-A

Armature control method : [below rated speed].

① Choose the proper ranges of meter after nothing the name plate details of the given machine and the name plate details of the given machine and make the connections as per the circuit diagram.

② Keep the motor field rheostat (R_f) in the minimum position and the armature rheostat (Ras) in the maximum position. • start the MG set.

③ Give supply and accelerate the motor using 3-point starter.

④ Decrease the armature rheostat value and note down speed and induced emf. in motor winding.

⑤ Tabulate these readings and plot the graph E_b vs N.

Part-B.

Field control method: [above rated speeds]

① Maintain the armature rheostat in maximum position and vary the field current (I_f) by varying the field rheostat. Notedown the speeds (N) at different values of field current. Take care that the speed doesn't exceed. 2000 rpm. Note down the armature voltage also.

② Tabulate these readings and plot the N vs I_f describes the field control of motor speed on no load.

Tabular column:

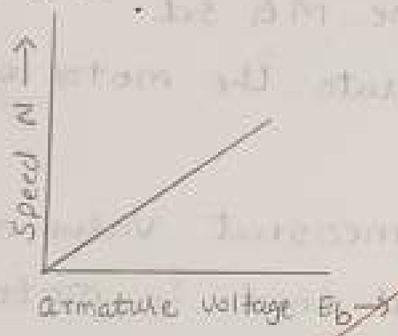
Armature control method

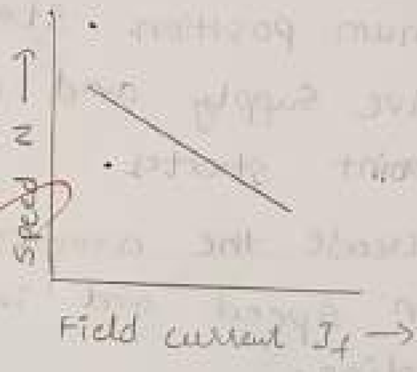
S.NO	E_b(volt)	Speed (rpm)
1	210	1500
2	140	1022
3	92	653
4	64	493
5	32	266

Field control method

S.NO	I_f(A)	Speed (rmp)
1	0.56	1500
2	0.5	1566
3	0.44	1647

Model graph:





Precautions: ① Avoid loose connections and parallax errors.

② Take care while using the starter.

③ Keep the armature and field rheostat at proper positions.

④ The speed should be adjusted to rated speed.