Laboratory Attendance Slip

Suman Kumar Dey

Electrical Engineering Department

Jadavpur University

Class CSc.E 1 Sec A1/A2 Experiment No 2 Lab. M/C Date 11.12.2023

Name of the Experiment 2. Measurement of Resistance of various electrical equipr

Roll Nos Assigned Group : 3) 25, (26) 27, 28, 29, 30, (31) 32, 33, 34, 35, 36.

Signature of Teacher Sujib Pal for S.K. Dey Date 11/12/2023

JADAVPUR UNIVERSITY

Faculty of Engineering & Technology

Electrical Engg. Laboratory

Name TATHAGATA SUR

Class CSE-UG1 Sec A1 Roll No. 002310501030

Date of Experiment 11/12/2023 Date of Submission 15/12/2023

Marks Obtained 8.0 Signature of Examiner

NAME	CO-WORKER	ROLL
EKORSHI CHAUDHURI		002310501034
ANIRUDH MODI		002310501031
KUSHAL BERA		002310501035
MOURYA SAHA		002310501036
PRATTAY KAR		002310501027
SHYAM SUNDAR KARMAKAR		002310501025
JOYOSMIT PAL		002310501028
ABIR CHAKRABORTY		002310501029
~~ANKIT SHAW~~		~~002310501032~~
SHUBHOM MALLICK		002310501033

Experiment No. 02

Commence at 11:00 AM Completed at 2:00 PM

Name of Teacher concerned Sanjib Pal (for S.N. Dey)

TITLE: Measurement of various resistance of an electrical machine.

OBJECT: (i) To measure the resistance of - (a) the field (b) the armature (both with & without carbon brushes) of a D.C. Machine

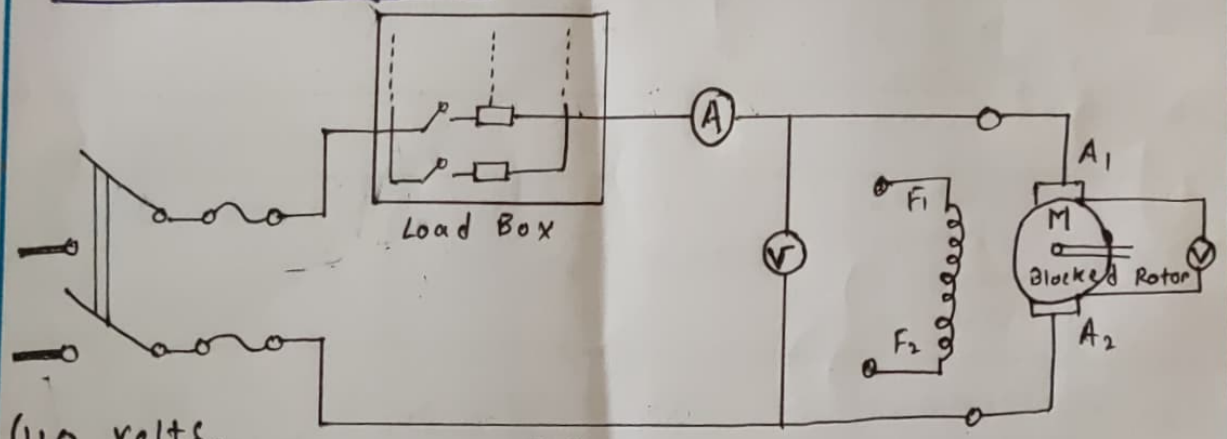
(ii) To measure insulation resistance of a D.C. Machine by using - (a) Voltage of known resistance and (b) Megger

EXPERIMENT NO: 2

Title: Measurement of various resistance of an electrical machine.

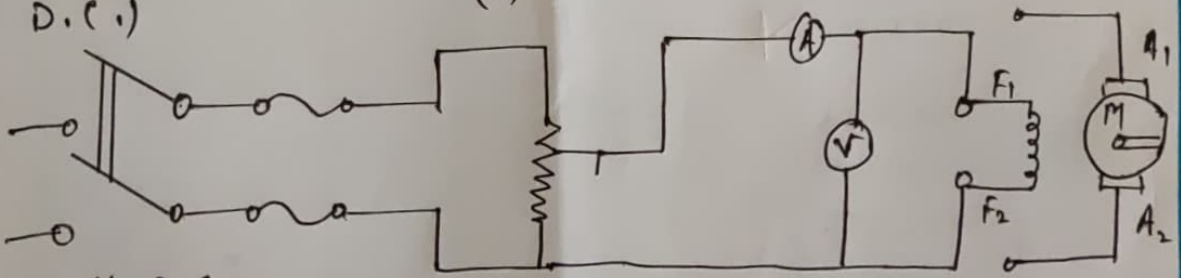
Objective: (1) To measure the resistance of –
(a) the field
(b) the armature (both with and without carbon brushes) of a D.C. Machine
(2) To measure insulation resistance of a D.C. machine by using –
(a) voltmeter of Known resistance
(b) Megger

Circuit Diagram:



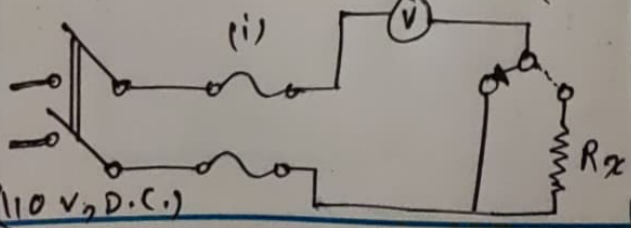
(110 volts, D.C.)

(a)



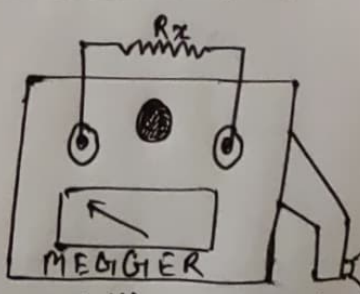
(110 V, D.C.)

(b)



(110 V, D.C.)

(c)



(ii)

Name Tathagata Sur

Roll 00231050103O

APPARATUS LIST:

Sl.No.	Items	Qty.	Range/Rating	Maker's Name	Maker's No.
1.	D.C. Generator	1	2 kW, 16A, 125V, type-B, frame = 225, Duty → Continuous, Hour → 40	General Electric	2445487 UF
2.	Megger	1	0-10000/50000/100 KΩ/ 150 K/200 K/... 100 MΩ (0-∞ Ω)	Megger Tester (England)	N 27 67621
3.	Rheostat	1	5A, 100Ω ± 10%.		
4.	Load Box	1	110V, 1A/2A/2A/ 5A/5A/5A	Jadavpur University (Dept. of EE)	JU/EE/ MC/LB/ 11 02 2007
5.	DC voltmeter	1	0-150 V	Automatic Electric Ltd.	M-29006
6.	DC voltmeter	2	0-30 V	MECO-V	A-86621
7.	DC voltmeter	1	0-200 V R_V = 50,000 Ω	weston Electric, Instrument NI, USA	264/ 165787
8.	DC Ammeter	2	(i) 0-2A (ii) 0-20 A	Automatic Electric Pvt. Ltd. Automatic Electric Pvt. Ltd.	M/29010 M/29012

Name Tathagata Sup Roll 002310501030

RUN 1

Measurement of Armature resistance with and without Brush

Armature Reading (in A)	Voltage Reading (in V) (with Brush)	Armature Resistance with Brush (R_{a_1}) (in Ω)	Voltmeter Reading (in V) (without Brush)	Armature Resistance without Brush (R_{a_2}) (in Ω)
2.1	1.8	0.86	0.8	0.38
3.2	2.6	0.81	1.2	0.38
6.6	4.6	0.7	2.4	0.36
8.6	5.8	0.67	3.0	0.55
9.6	6.4	0.67	3.2	0.33
12.5	8.4	0.67	4.4	0.35
13.4	8.8	0.66	4.8	0.36
18.4	10.4	0.63	5.6	0.34

Run-2

Measurement of Field Resistance

Voltmeter Reading (in V)	Ammeter Reading (in A)	Field Resistance (in Ω)
10	0.08	125
20	0.14	142.9
30	0.22	136.9
40	0.24	137.9
50	0.36	138.9
60	0.43	135.5
70	0.51	137.3
80	0.58	137.9
90	0.66	136.4
100	0.73	137
110	0.81	135.8

Mean Field Resistance = 136.86 Ω

Run-3

Measurement of Machine Insulation Resistance Using Meggar

Armature to body insulation resistance = 0.3 MΩ

Field to body insulation resistance = 0.5 MΩ

Run-4

Measurement of Machine Insulation Resistance Using Voltmeter

Supply Voltage (V_1) = 110 V ; voltmeter Resistance (R_V) = 50000 Ω

Armature to body Insulation voltage (V_2) = 32 V

∴ Armature to body Insulation resistance

$$(R_x) = R_V\left(\frac{V_1}{V_2} - 1\right) = 50000\left(\frac{110}{32} - 1\right) \approx 0.122 \text{ MΩ}$$

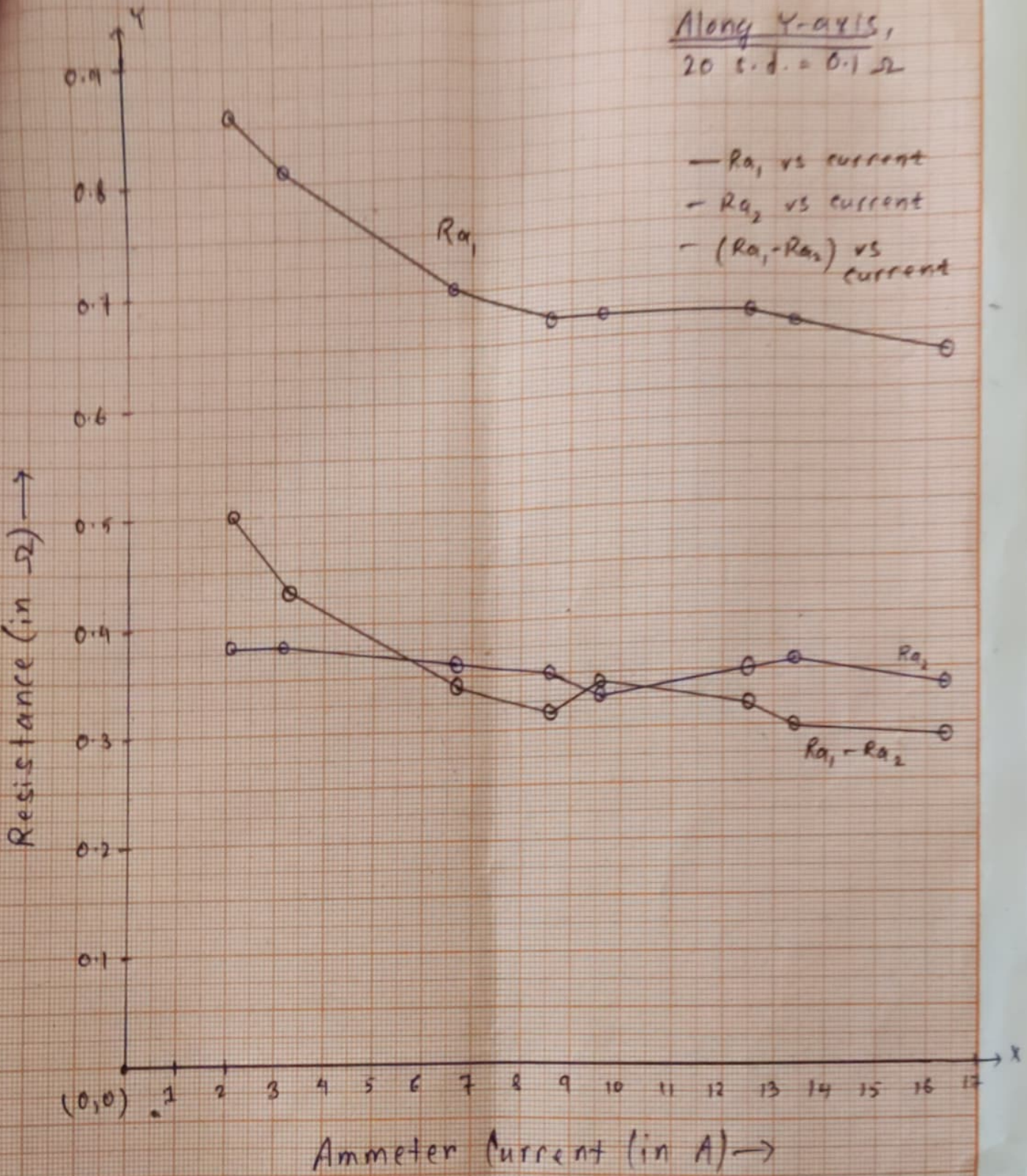
Scale:-

Along X-axis,

10 c.d = 1 A

Along Y-axis,

20 c.d. = 0.1 Ω



Jadavpur University
Graph Paper - M.M. Division

Tathagata Sur, 002310501030, CSE, UG1, EEE dept., Expt.-02

SAMPLE CALCULATION

RUN - I : (a) Ammeter reading (I) = 9.6 A
and Voltmeter Reading (V) = 6.4 V
⇒ Armature resistance with brush, $R_{a_1} = \frac{V}{I} = \frac{6.4}{9.6} = 0.67\ \Omega$

(b) Ammeter Reading (I) = 9.6 A
and voltmeter Reading (V) = 3.2 V
⇒ Armature resistance without brush, $R_{a_2} = \frac{V'}{I'} = \frac{3.2}{9.6} = 0.33\ \Omega$

RUN - II :
Voltmeter Reading (V) = 60 V
Ammeter Reading (I) = 0.43 A
⇒ Field Resistance (RF) = $\frac{V}{I} = \frac{60}{0.43} = 139.5\ A$

Average armature resistance (with brush), R_{a_1}
$= \frac{1}{8}(0.86 + 0.81 + 0.7 + 0.67 + 0.67 + 0.67 + 0.66 + 0.63)$
$= 0.708\ \Omega$

Average armature resistance (without brush),
$R_{a_2} = \frac{1}{8}(.38 + .38 + .36 + .35 + .33 + .35 + .36 + .34)$
$= 0.356\ \Omega$

Average Field resistance R_F
$= \frac{1}{11}(125 + 142.9 + 136.9 + 137.9 + 138.9 + 139.5 + 137.3 + 137.9 + 136.4 + 137 + 135.8)$
$= 136.86\ \Omega$

REPORT-3

① Ratio between field copper loss at rated current and rated output of the machine:

Field resistance (average) = 136.86 Ω
Rated current = 16 A
Rated output of machine = 125 × 16 = 2000 W

$$\Rightarrow \frac{\text{Field copper loss of rated current}}{\text{Rated output of the machine}} = \frac{16^2 \times 136.86}{2000} = 17.52$$

② Ratio between armature copper loss at rated current and rated output of the machine:

Armature resistance = 0.708 Ω
Rated current = 16 A
Rated output of machine = 2000 W

$$\Rightarrow \frac{\text{Armature copper loss at rated current}}{\text{Rated output of the machine}} = \frac{16^2 \times 0.708}{2000} = 0.0906$$

REPORT-4

Comparison of insulation resistance obtained from RUN-III and RUN-IV

RUN-III

Insulation Resistance (using Megger)

Armature to Body Resistance = 0.3 MΩ = 300 kΩ
Field to body resistance = 0.5 MΩ = 500 kΩ

RUN-IV

Insulation Resistance (using voltmeter)

Armature to Body Resistance = 0.122 MΩ = 122 kΩ
Field to body Resistance = 0.49 MΩ = 490 kΩ