Load test of DC shunt Motor

(Hardware)

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Experiment No:	7	**Reg. No:**	21BAI1611

AIM:

To conduct load test on the given DC shunt motor and to draw the following characteristic curves.

A. Armature current Vs Torque (Electrical Characteristics)
B. Speed Vs Torque (Mechanical Characteristics)
C. Performance characteristics
   a. Output power Vs Speed
   b. Output power Vs Current
   c. Output power Vs Torque
   d. Output power Vs Efficiency

APPARATUS REQUIRED:

S.NO	APPARATUS	RANGE	TYPE	QUANTITY
1.	Voltmeter	(0-300)V	MC	2
2.	Ammeter	(0-20)A	MC	1

3.	Rheostat	270Ω/2 A		1

PROCEDURE:

1. Connections are given as per the circuit diagram.

2. Verify whether the field rheostat of the motor is kept at minimum position.

3. By closing the DPST Switch, 230V DC Supply is given.

4. Start the motor by using a 3 point starter.

5. The field rheostat of the motor (i.e., excitation) is adjusted so as to make the motor to run at rated speed. After adjusting the rheostat to the rated speed it should not be altered.

6. At no load condition, the input voltage, current, speed are noted.

7. Load is applied to the motor up to 125% of rated value by using Brake Drum and the corresponding

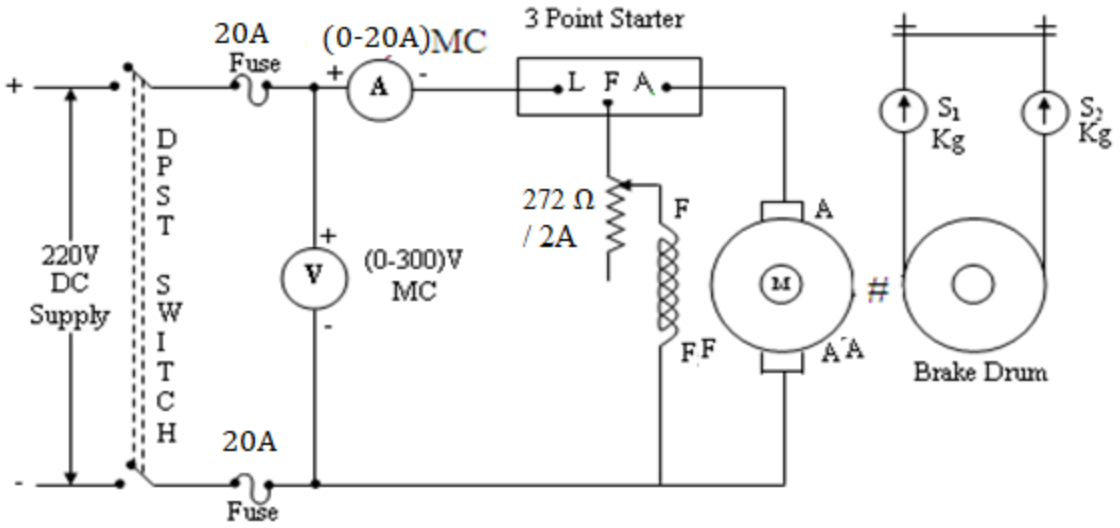
reading is tabulated.

8. Load is gradually decreased and field rheostat is brought to its original position and supply is switched

off.

9**.** From the tabulated values the performance characteristic curves are drawn.

CIRCUIT DIAGRAM:



FUSE RATING:

125% of rated current

NAME PLATE DETAILS:

Rated Voltage : 220V
Rated Current : 18.6A
Rated Power : 3.5kW
Rated Speed : 1500 RPM

FORMULA USED:

1.F=[S_1-S_2] Kg.
Where F = Force in Kg.
S_1, S_2= Spring Balance readings in Kg.

2. Torque (T) = 9.81 *F*R
Where R= Radius of the Brake Drum in metre.

3.Input Power (P_{in}) =V_{in} * I_{in} Watts

V_{in} =Input voltage in Amperes

I_{in} = Input current in Amperes

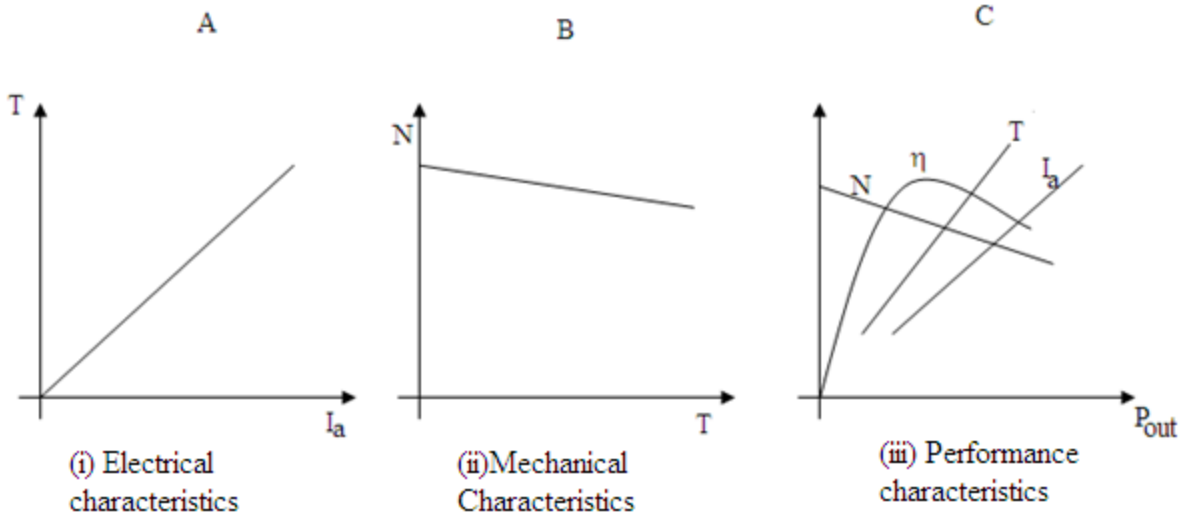
4. Output power (P_{out}) =2*π* N*T/60 watts

Where N= Speed of the motor in rpm

T= Torque in Nm.

5. Percentage Efficiency, η = (P_{out} / P_{in})*100

MODEL GRAPH:



(i) Electrical characteristics

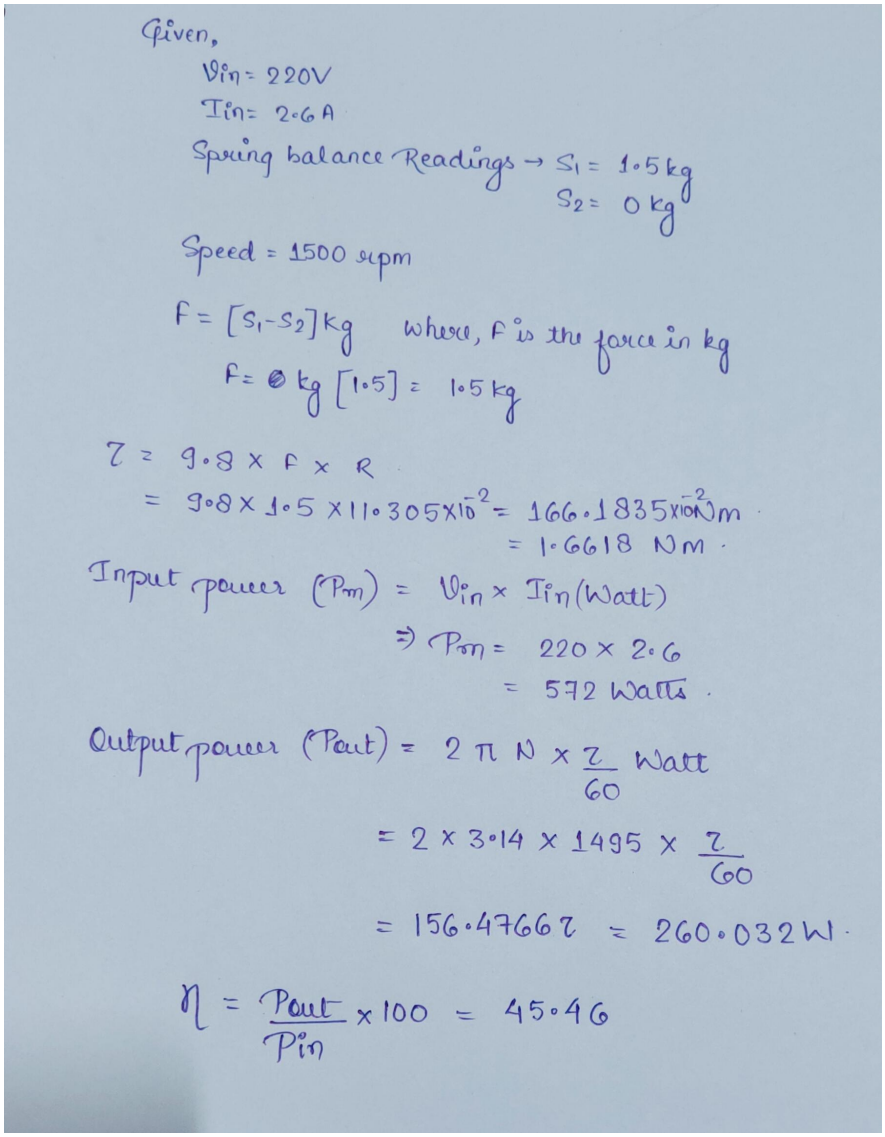
(ii)Mechanical Characteristics

(iii) Performance characteristics

TABULATION:

S.No	Input Voltage V_{in}	Input Current I_{in}	Spring Balance Reading			Speed N	Torque T	Input Power P_{in}	Output Power P_{out}	Efficiency, $\eta = P_{out}/P_{in}$ X 100
			S1	S2	S1~S2					
	Volts	Amps	Kg	kg	Kg	RPM	Nm	Watts	Watts	%
1.	220	2	0	0	0	1500	0	440	0	0
2.	220	2.6	1.5	0	1.5	1495	1.6618	572	260.032	45.46
3.	220	3.4	3	1	2	1487	2.2170	748	345.227	46.15
4.	220	6.0	8	2	6	1474	6.6511	1320	1026.64	77.77
5.	220	10	12	2.5	9.5	1461	10.5310	2200	1611.19	73.23
6.	220	12	17	3	14	1458	15.5194	2640	2369.52	89.75
7.	220	13.6	18	3	15	1453	16.6279	2992	2530.06	84.56

MODEL CALCULATION:



Given,

$V_{in} = 220V$

$I_{in} = 2.6A$

Spring balance Readings → $S_1 = 1.5kg$

$S_2 = 0kg$

Speed = 1500 rpm

$F = [S_1 - S_2]kg$ where, F is the force in kg

$F = 0kg\ [1.5] = 1.5kg$

$T = 9.8 \times F \times R$

$= 9.8 \times 1.5 \times 11.305 \times 10^{-2} = 166.1835 \times 10^{-2} Nm$

$= 1.6618\ Nm$

Input power (P_{in}) = $V_{in} \times I_{in}$ (Watt)

$\Rightarrow P_{in} = 220 \times 2.6$

$= 572$ Watts.

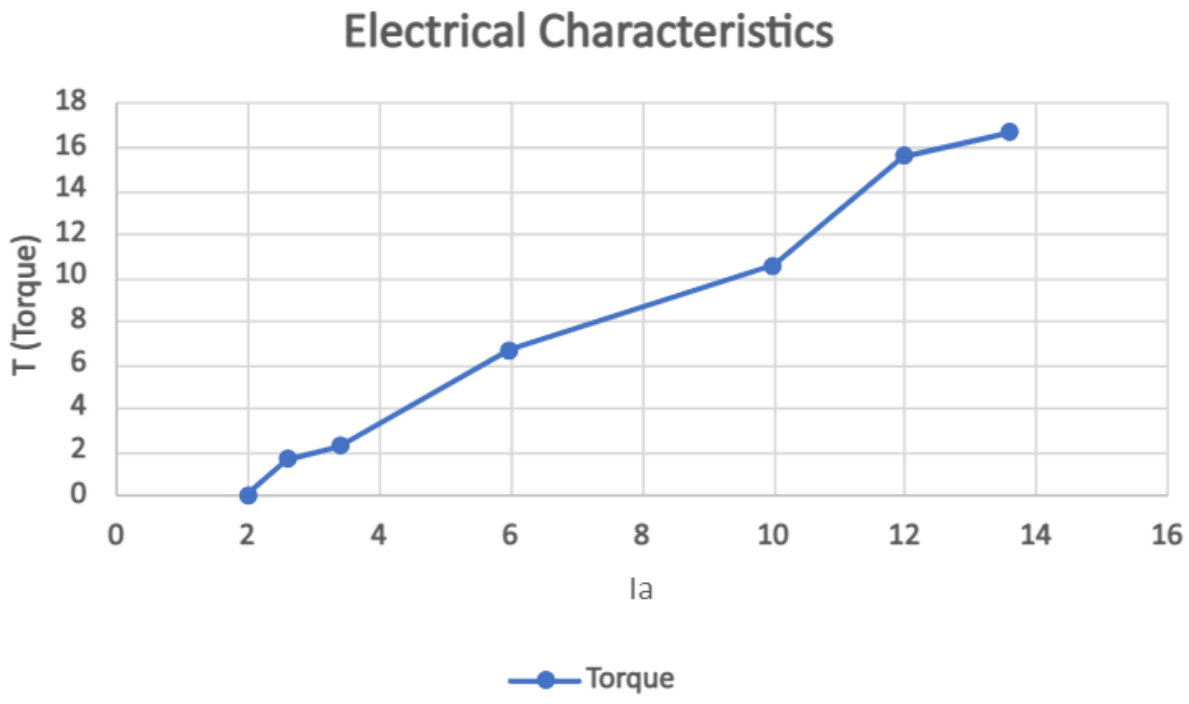
Output power (P_{out}) = $2\pi N \times \frac{T}{60}$ Watt

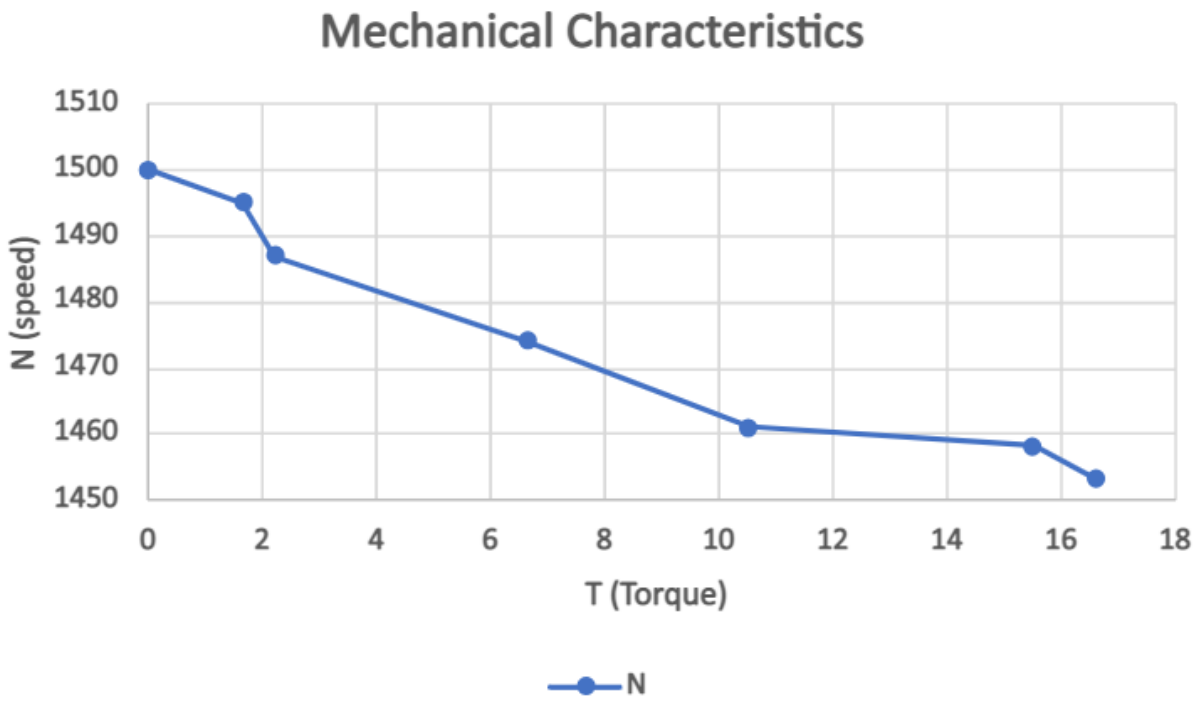
$= 2 \times 3.14 \times 1495 \times \frac{T}{60}$

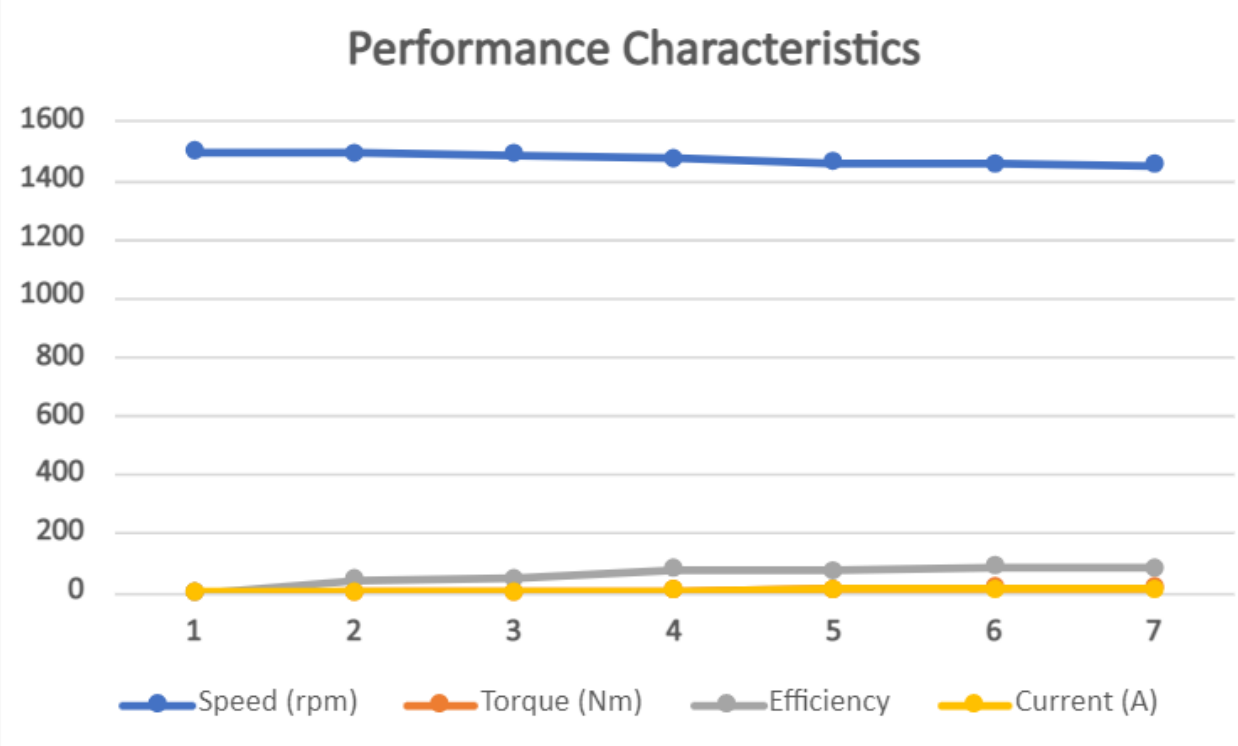
$= 156.47662 = 260.032W$

$\eta = \frac{P_{out}}{P_{in}} \times 100 = 45.46$

GRAPHS :


Electrical Characteristics
T (Torque)
18
16
14
12
10
8
6
4
2
0
0
2
4
6
8
10
12
14
16
Ia
Torque


Mechanical Characteristics
N (speed)
1510
1500
1490
1480
1470
1460
1450
0
2
4
6
8
10
12
14
16
18
T (Torque)
N



RESULT:

Thus the load test on a DC shunt motor is conducted and the performance characteristic curves are drawn.