CHAPTER 3

METHODOLOGY

3.1 Equipment overview

Figure 3.0: MG-5211 DC Motor/DC Generator

The equipment used in this project is MG-5211 DC Motor/DC Generator **(Figure 3.0)**. It offers a variety of experiments centered on the characteristics of DC motors and generators.

The DC motor experiments in MG-5211 cover the two most important motor types : a Shunt Winding Motor and a Series Winding Motor, while the DC generator experiments are mainly focused on a Compound Winding DC Generator.

Provisions are made at various locations in the trainer for the students to measure important voltage or current values associated with each experiment. Most cases, voltages and currents are adjustable too. Also, the load of the generator is adjustable as well.

The input of the motor is DC 115V, and the output of the generator is 120V, 1A max.

3.2 Equipment Specifications

3.2.1 Motor Section

i) Winding Type	Shunt & Series (DC Machine)
ii) Speed	1250~1800 RPM
iii) Shunt Field Exciting	120V, 0.4A Approx.
iv) Number of Poles	2 Poles
v) Motor Input	115V, 3.5A Approx.
vi) Motor Power	1/3 HP
vii) Shunt Rheostat	0~300Ω, 50W
viii) Armature Rheostat	0~10Ω, 80W
ix) Indication Meter	Input Voltage
	Shunt Field Current
	Armature Current
	RPM Meter
x) Overload Trip	4A Approx.
xi) Motor constant	0.706

3.2.2 Generator Section

i) Winding Type	Compound Winding
ii) Speed	1800 RPM
iii) Output Power	120V, 1A (max)
iv) Number of Poles	2 poles
v) Field Exciting	Self Exciting
vi) Shunt Rheostat	0~300Ω, 50W
vii) Series Field Rheostat	0~50Ω, 50W
viii) Indication Meter	Shunt Field Current
	Series Field Current
	Output Voltage
ix) Overload Trip	2A Approx
x) Load Resistance	48Ω~480Ω, 200W

3.2.3 General Specifications

i) Input Power	AC220V, 60Hz
ii) DC Source Output	DC 0~120V, 5A
iii) Motor Dimensions	145mm(diameter)x 255mm(length)
iv) Generator Dimensions	145mm(diameter)x 215mm(length)
v) System Dimensions	920(W) x 670(H) x 460 (D) mm
vi) System Weight	4.6 kg
vii) Accessories	Wiring Cords (4φ Plug) : 14ea
	AC Line Cord : 1ea
	Operating Manual : 1ea

3.3 Operational Precautions

1) Live electric potentials are dangerous. Avoid direct contact to human body with any live electric wires.
2) Always make sure that an electrically operating system is properly protected against overloads.
3) Any wiring in a system should be done with the main as well as any other power switches involved are turned off.
4) Mechanical couplings between components, such as a motor, a generator and a dynamometer, must be firm and reliable.
5) Re-check all the wiring before turning the power on.
6) Whenever an overload trip occurs, turn the power off and correct the situation before applying the power again.
7) Be careful with the test leads so that they don't get accidentally caught in a rotating machine or make contact with a live part.
8) After an experiment is over, make sure the power is off and all the cord connections are removed from the machine.
9) The instantaneous current at the moment a motor starts is almost 7 to 10 times higher than the normal steady state current. Therefore, make sure an ammeter is set for high enough range to respond to the peak current.
10) When an ammeter is removed from a field or an armature circuit, make sure proper jumper connection is made at where the ammeter was in the circuit.
11) Before a motor is turned on or off, or the main power switch is turned on or off, turn down the Power Source adjust which is at the left side of the trainer to a minimum position.
12) Before the load is turned on or off, or the load is changed to a new value, turn off the Output switch first.

3.4 Steps and procedures

1) Make sure the connection between the motor and generator is secure and reliable. Keep the Main, Motor and Generator Output switches off.

2) Connect between the DC 0~120V source terminals and the motor input terminals using patch cords. Set the DC Source voltage control on the left of MG-5211 fully counterclockwise.

3) Turn RH-1 (shunt field resistance) of the motor circuit fully counterclockwise, and RH-2 (armature resistance) into 5Ω.

4) Turn on the power supply and switch on the input and motor.

5) Adjust the voltage control until the voltage input is 100V.

6) Slowly, increase RH-1(shunt field resistance), starting with 30Ω. Observe the motor speed (rpm), the field current (flux, Φ) and armature current (I_a). Record the data of these reading into a table 4.1.

7) Repeat step 6 by increasing the RH-1 (shunt field resistance) each 30Ω until the maximum value that is 300Ω.

8) After finishing the steps, stop the motor. Turn the DC source down to minimum and turn Main and Motor switches off.