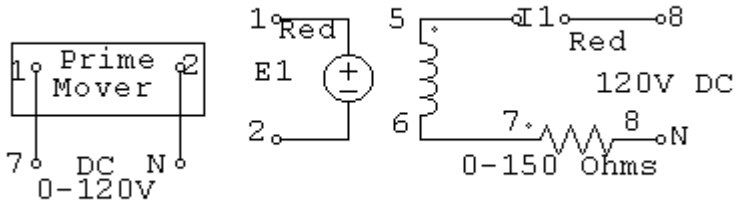
MACHINES LABORATORY - 9

DC MACHINES

In this experiment, you would determine the characteristics of several types of D.C. generators and motors.

PART A: Open Circuit Characteristic of a separately excited generator.

Step 1: Connect the network shown below.



Step 2: The prime mover is to be mechanically coupled to the dc machine (by a belt).

Step 3: Set the MODE switch (Switch right of the Prime Mover box) to the PRIME MOVER side. Connect the terminals Speed, Torque and Ground on the Prime Mover Module to the corresponding terminals on the Data Acquisition Module using the signal leads (red thin leads). Select to display Speed on the prime mover module.

Step 4: Increase the prime mover input voltage by turning the voltage control. Set the speed at 1200 RPM.

Step 5: Reduce the field current I1 to zero by opening the wire connecting terminals 6 and 7 in the field circuit. Record data. Set field resistance at 150 Ohms. Reconnect terminals 6 and 7. Record DATA. You can increase I1 by decreasing the field circuit resistance (0-150 Ohms). Record DATA for several I1. See the plot of E1 Vs I1. The graph is called OCC (open circuit characteristic). Clear DATA. While recording DATA, the successive recorded values of I1 should be increasing. Otherwise, the plot would have loops.

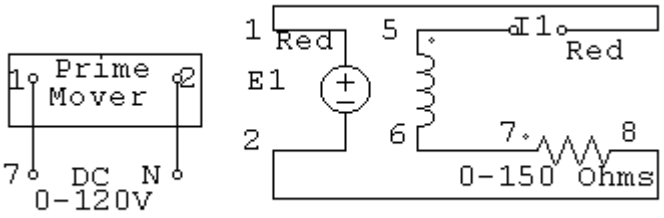
Step 6: Change the speed to 1500 RPM and repeat Step 5.

Step 7: Set the field resistance at about 75 Ohms (half way between 0 and 150 markings). Reduce the speed to zero (Use the Voltage Control Knob). Record Data. Change the speed and record DATA at several speeds in the range 0-1800 RPM. Plot E1 Vs Speed. Note that E1 is proportional to speed.

PART B: Shunt Generator.

In Part A, the field current is derived from an external source. We can obtain the field current from the voltage generated across the armature terminals 1 and 2. The initial voltage across terminal 1 and 2 is due to residual magnetism. You would be finding the conditions under which voltage builds up across the armature terminals.

Step 1: Connect the circuit shown below. It is a simple modification of circuit of Part A.



Step 2: Set the field resistance to 150 Ohms.

Step 3: Increase the speed of the prime mover to 1500 RPM. Do you see E1 increasing to about 100 V? Reduce the speed to zero.

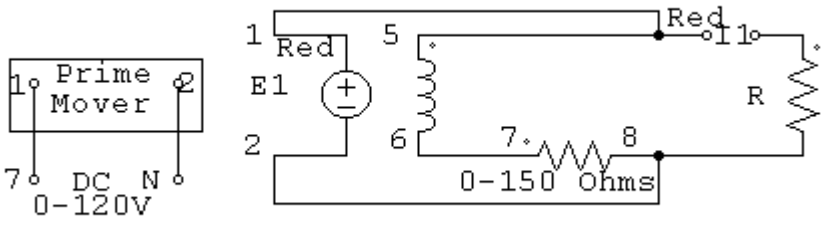
Step 4: Set the field resistance to zero. Repeat Step 3.

Step 5. Reverse the field current direction. You can do so by "interchanging the connections of terminals 5 and 6. Repeat Steps 2 to 5.

Step 6: Reverse the direction of rotation of the prime mover. You can do so by interchanging terminals 1 and 2 of the prime mover. Repeat Steps 2 to 5.
State the conditions under which a shunt generator "builds up" the voltage.

PART C: Load Test on a Shunt Generator.

Step 1: Connect the circuit shown. Note that I1 measures Load Current.

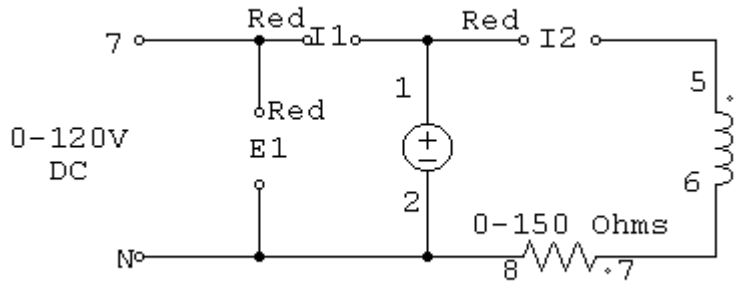


Step 2: Set the voltage of the generator at 100 V at 1000 RPM. Set R at infinity. Record DATA.

Step 3: Set R at 600 Ohms and record DATA. Set R at 300 Ohms and record data. Set R at 200 Ohms and record data. Plot E1 Vs I1. It is called Load Characteristic.

PART D: Load Test on a Shunt Motor

Step 1: Connect the circuit shown. Make sure that the voltage control is set at zero.



Step 2: Set the MODE switch to Dynamometer. Set the Load Control to manual. Set field resistance to zero. Increase the voltage control such that E1 reads 110 V. increase field resistance such that the speed is 1700 RPM. Make sure that data regarding speed and torque (compensated torque: Input torque of the dynamometer) are acquired. The torque displayed is the output torque of the dynamometer. Record DATA.

Step 3: Vary load control and record data for various settings. I1 should not exceed 3 A. Plot Speed Vs Torque. Set the voltage control to zero. Clear DATA

Step 4: Set the field resistance at 150 Ohms. Set the Load Control at the minimum. Increase the input voltage such that E1 is 110 V. Record DATA. Decrease the field resistance and record DATA for several settings. Plot Speed Vs I2.
Clear DATA. Reduce the applied voltage to zero.

DATA: Part A

Step 5: Speed: _____ RPM

I1								
E1								

Step 6: Speed: _____ RPM

I1								
E1								

Step 7: I1 = _____ A

E1								
Speed								

Part B:
Conditions for Self Excitation: 1. _____

2. _____

Part C:

	R = infinity	600 Ohm	300 Ohms	200 Ohms
E1				
I1				

Part D

Steps 2 and 3:

Torque					
Speed					

Step 4:

I2					
Speed					