ECE 207 **Lab Work 15** **Due November 8th**

Names _____

Objectives

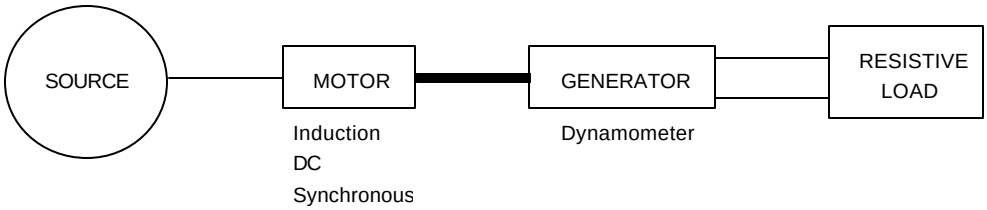
1. Gain an understanding of the electromechanical energy conversion principles.
2. Become familiar with the operation of dc machines.
3. Learn to connect the dc machines as electric motors or generators.

Deliverables

Completed procedure

Procedure

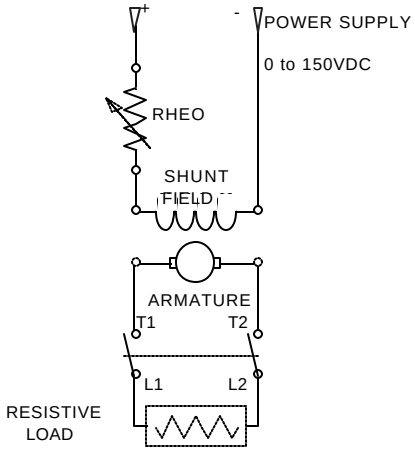
This experiment is designed to allow you to use the a motor driving a generator (also called a dynamometer) to measure the perfo rmance of rotating machines. In this experiment, pay close attention and document the consequences of a change in the control variable and/or the generator loading on the input current of the motor.

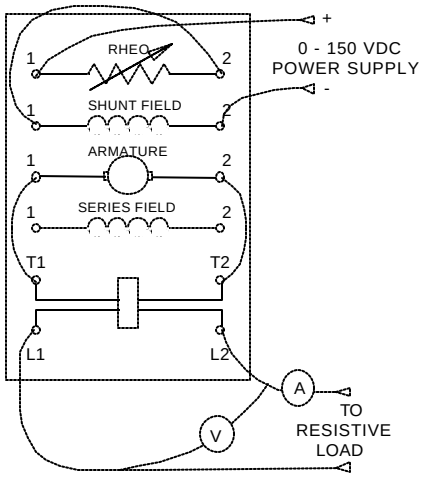


The electrical energy generated by the generator is dissipated in the resistive load. The torque produced by the generator is displayed by the electronic LCD torque indicator. The generator speed is measured by counting the visible light pulses reflected from the tape on the machine shaft coupling. The speed is displayed electronically by the red LED display.

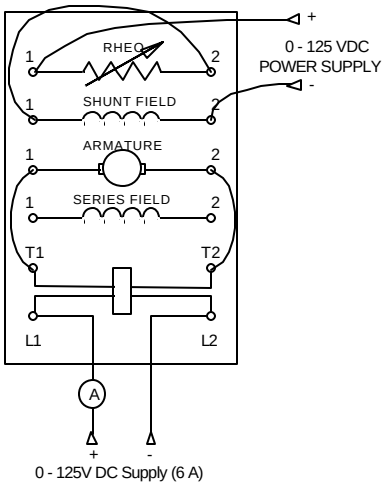
Set all power supplies to zero volts and calibrate the torque indicator to read a zero value. Then proceed with the following parts of the experiment.

Connect the generator as shown below. Note that the output is connected to the resistive load box.





1. Connect the DC motor as shown below. Remove the resistive load from the generator by turning the switches off.



2. Set the DC motor field voltage to approximately 80% (that is set the dial to 8) of its maximum rating. Next, increase the armature voltage until the machine reaches ~1500 RPM. Record how the machine speed changes as the armature voltage is further increased to 125V. With E_a at this voltage, reduce V_f (you will just record the dial reading as the voltage is not measured). Document how the motor speed changes to 2000rpm.

With V_f fixed and E_a increased from _____ to _____, n_m went from _____ to _____

With E_a fixed and V_f reduced from _____ to _____, n_m went from _____ to _____

Comment below on the relationship between V_f, E_a and n_m.

3. Adjust the motor field voltage until the machine reaches 1800 RPM.

   i. Adjust the field voltage of the generator until the generator output voltage is 90V. Increase the resistive load in four steps. *When the armature current on either machine is above 2.4A, take the readings promptly to avoid overheating.* (All nine will be an overload)

parallel load Ω	shaft			motor				generator				overall
	torque	rad/s	power	V	I	P	η	V	I	P	η	η
3 x 600												
3 x 300												
3 x 150												
All 9												

What do you conclude about efficiency and loading?

   ii. Keep the load resistance fixed at 3 x 150Ω in parallel and adjust the field voltage of the dynamometer to obtain an armature voltage of 100V. Call this level 100%. Reduce the field voltage of the generator in a few steps and record the values of the above variables.

field %	shaft			motor				generator				overall
	torque	rad/s	power	V	I	P	η	V	I	P	η	η
100												
75												
50												
25												

What do you conclude about generator field strength and loading?