ET 332a
Laboratory Activities and Experiments

1.) **Using Spreadsheets in Laboratory Calculations**
(Handouts)
The Excel spreadsheet is introduced and used to produce graphs that are commonly found in technical reports. Linear graphs are produced. Semi-log plots are created by using a log function to reduce the range of the data and by using the scaling abilities of the spreadsheet. Embedding the results into reports is also demonstrated. The Microsoft Equation Editor is demonstrated. A student activity uses the developed skills to make plots and produce professional solutions to technical problems.

2.) **Power Laboratory Safety and Work Procedures/Resistance of DC machines**
(Hampden Experiment 1)
Students are instructed in high voltage laboratory safety rules. Avoiding electric shock and other safety hazards encountered in the power lab are covered. The basic operation of the fractional-horsepower motor lab equipment will be covered The class will perform a simple experiment to determine the dc resistance of the field and armature coils of a typical dc motor.

3.) **Saturation Curve of a Generator**
(Hampden Experiment 2)
The main object of this lab is to obtain the necessary data to plot a saturation curve of a separately excited dc generator. The shape of this curve is a scaled representation of a machine's B-H curve. The effects of saturation on the output of a generator are observed.

4.) **Counter EMF Force**
(Hampden Experiment 16)
The counter EMF force of a dc machine will be observed. The laws of induction and force on a conductor will be verified using a dc machine.

5.) **Load Characteristics of a Separately-Excited Shunt Generator**
(Hampden Experiment 6)
The load level Vs terminal voltage characteristic of a separately-excited shunt generator is developed. The voltage output capabilities of the machine are examined at the rated speed and field current of the device.

6.) **Shunt Motor Characteristics**
(Hampden Experiment 18)
The speed-torque characteristic of the shunt dc motor is determined experimentally. The speed regulation of the machine will be found. The relationship between the load torque and the armature current is examined.

7.) **Efficiency and Losses in a Dc Shunt Motor**
(Hampden Experiment 21)
The operating efficiency of a shunt dc machine will be determined by lab tests. The sources of losses in dc machines are identified and measured. These losses can be divided into fixed and load-variable components.

8.) **Series Motor Characteristics**
(Hampden Experiment 19)
The speed-torque characteristic of the series dc motor is determined experimentally. The speed regulation of the machine will be found. The relationship between the load torque and the armature current is examined.

9.) **Compound Motor Characteristics**
(Hampden Experiment 20)
The speed-torque characteristic of the compound dc motor is determined experimentally. The speed regulation of the machine will be found. The relationship between the load torque and the armature current is examined.

10.) **Shunt Generator Output Polarity and Voltage Build-up**
(Hampden Experiment 3)
This experiment covers the correct procedures for preparing a shunt generator to for operation. The voltage build-up process is examined. The proper connections for voltage build-up are given.

11.) **Field Resistance Vs Generator Voltage Build-up/Motor Control Simulator**
(Hampden Experiment 4)
This lab examines the affects of field resistance on generator voltage build-up. The lab demonstrates the effect of excessive field resistance on terminal voltage. The second section introduces ladder diagrams and motor control with an animated, computer-based simulator.

12.) **PV Array Economics Report**

Students survey the Web and other technical resources to determine the cost and feasibility of utilizing solar power in a grid-tied residential application. A short report summarizes the findings.

Lab Reporting Format

The laboratory procedure will be handed out approximately a week before it will be performed. Reading the lab prior to lab makes the performance of the experiment more efficient. All data collected in lab must be initialed and dated by the lab instructor. All reports submitted without instructor verification will receive a zero.

The experiments for this course will be reported in an abbreviated format. The laboratory handout has an experiment objective and procedure included. There is no need to restate these sections in another report. To fully document the results of the experiment, all questions, problems and graphs required by the laboratory handout must be completed. Also, a discussion of the topics covered in the experiment and how they relate to the lecture material should be completed. This discussion should be at least one page type written and double-spaced.

The report should have the following sections:

1.) Cover page that is like the one attached to this document
2.) All the pages from the laboratory handout that have questions, problems, tables, graphs.
3.) Discussion

It is permissible to answer the questions/problems on a separate sheet, but the questions and problems must be numbered and all the answers typed. Some of the lab handouts have places to make graph in them. It is also permissible make graphs using software packages such as Excel instead of using this page. If a graph is made on a separate sheet it must have:

1.) A title
2.) Labels on each axis
3.) Units on each axis
4.) A legend if more than on curve is on the same axis. This identifies each curve on the graph.

The graphs should be scaled to show the data in the most meaningful way. Change the graph limits so the curve covers most of the axis.

Hints for Good Reports

1.) Follow the format. If you are not sure about how something should be done, ask the lab or lecture instructor.
2.) Use computer tools whenever possible. (Word processors, drawing tools spreadsheets) If you have never had any experience with some of these tools or have a question about how to perform a function using the common software tools ask the lab or lecture instructor.
3.) Spell-check the document.
4.) Proof-read the document at least once.

Department of Technology

ET 332a
Electromagnetic Principles and Devices

Experiment #

Experiment Title

Reported by: your name here

Performed By: student name 1
student name 2
student name 3

Date Performed: