EE-340 LABORATORY MANUAL

ELECTROMECHANICAL
ENERGY CONVERSION

Dr. H. Saadat
Version 1.0

MILWAUKEE SCHOOL OF ENGINEERING
Department of Electrical Engineering
And Computer Science

ELECTROMECHANICAL ENERGY CONVERSION

TABLE OF CONTENTS

LABORATORY SAFETY RULES

When working in the Industrial Control laboratory, there are several rules, which must always be observed:

1. Do not close the power supply switch until the instructor has checked connections.

2. Be sure to inform all group members before power is switched on and after it is switched off.

3. Do not change the circuit components with the power on. Turn the power off. Beside the danger to yourself, you could damage the components if you change them with the power on.

4. Use only one hand for component adjustment with power on during the experiment. This minimizes the danger of electrical shock.

5. Avoid placing any part of your body across live terminals or from such terminals to ground.

6. Safety goggles must be worn when operating electric machines. Also, do not wear loose clothing, which could become entangled in moving parts.

7. Report any defective equipment or components to the instructor. Instructor will tag the equipment with date and a brief explanation of problem.

8. Know where the emergency stop palms buttons are located in the laboratory and use them when it is necessary to quickly remove all power.

9. In case of emergency:
   a. De-energize the circuit and depress any one of the emergency palm buttons.
   b. Notify the instructor as quickly as possible.
   c. In case of fire, use the extinguishers that can put out electrical fires. Call the Public Safety Department (7159) if necessary. Pull fire alarm, evacuate the building, and call from someplace outside if the fire is serious.

LABORATORY PROCEDURE

The students should always work in squads of two or more. Always have the lab instructor check the wiring before turning the bench power supply on and energizing the circuit. When disconnecting or modifying the circuit, first turn off the power.

There are four drawers in each bench containing power cords, AC and DC meters, AC series motor, a capacitor, and a 5Ω , 1000 W resistor. The cabinet behind each bench contains AC and DC starter boxes, two field rheostats and one DPST SW box. A resistive load on the bench consists of six 60 W resistors in parallel, providing six load steps. Students are not allowed to remove and/or replace equipment from anywhere but the bench drawers of the assigned bench without permission of the instructor.

When you have completed your experiment, have the instructor check and initial your notebook. Return all equipment to your drawers in their proper locations. Equipment taken from the cabinets and all leads must be returned to their original locations. Just before you leave the laboratory, put your stools back under your bench and clean up all paper and scraps.

LABORATORY REPORT

Students are expected to read the material for each experiment prior to attending the lab. Each student should keep a spiral science notebook. The notebook should contain a complete record of all laboratory work, including pre-laboratory analysis, circuit diagrams, lab data, computer results and graphs.

A formal report is required for some of the experiments. The formal report should have the name of the experiment in the middle of the page, and in the lower right hand corner the following:

COURSE/SECTION
DATE
STUDENT NAME
PARTNERS
INSTRUCTOR

The formal report (and to some degree the informal report) should include the following topics in the order presented below:

PURPOSE
This should clearly and concisely state the objectives for the experiment in suitable engineering terminology.

BACKGROUND AND THEORETICAL DISCUSSION
The background necessary to understand the main principles in the experiment. Integrate the pre-laboratory analysis in this section.

PROCEDURE
A brief description of what was done in the laboratory written in past tense. All circuit diagrams drawn neatly with template should be included here. Use third person in the passive voice. Don't use the pronouns I, we, us, etc. Thus in place of a statement "We measured the current ... ", use the statement "The current was measured ..."

RESULTS
This section contains data obtained in tabular form including derived data. This section should not contain any text other than table headings, column titles and units. A subsection for **sample calculations** must be included which shows a sample of each type of calculation made for the data. Place all graphs here. Include graph title, legend and label all axes. All curves must be drawn smooth and continuous. No computer programs or MATLAB statements should appear in this section. If you need to include any programs place them in the Appendix.

DISCUSSION OF RESULTS
Summary of results, answers to all questions and make sure all the report requirements are addressed. All statements should be supported by the data or by the theory. You must analyze your data and state why your graphs are shaped the way they are. Relate your results to the theory where appropriate.

CONCLUSION
Draw appropriate conclusions, and where possible, relate the results to engineering applications. What did you achieve and what recommendations do you make for further work, if appropriate.

The original manuscript was developed by Dr. Hadi Saadat in 1989 and was written using the Chi Writer word processor. After few revisions in 1993 and 1997, I have written this new version with several modifications in MS Word format. This Laboratory Manual is available on the Internet for download only for MSOE students and faculty.

Dr. Hadi Saadat
Winter 2000-01