INSTRUCTIONS FOR ELECTRONICS I & II LABORATORY

Organization

Students will be divided into groups of two or three. Each group will be assigned a group number and will use the bench, the computer and the set of equipment that bears their group number, only. Switching of equipment or members among groups cannot be done without the consent of the instructor.

ELE 342 (ELE343) is a 4 credit course which requires about 3 hours per week scheduled laboratory work in addition to the 3 hours of lectures and in-class participation. The laboratory work is a group activity. All members of a group are expected to be present and participate in conducting an experiment with as much equal contribution as possible. All members of a group are expected to come prepared, and complete the work within the scheduled laboratory period with their laboratory partners. No individual member and no individual group will be allowed to do an experiment outside the scheduled times except under extenuating circumstances and only with the consent of the instructor.

Purpose and Procedure

The purpose of this course is to cultivate in the student a degree of independence in carrying out an engineering task. The burden (and reward) of success is the student's, not the instructor's.

The student will perform specific electronic experiments as indicated by handouts for each experiment. These handouts are generally specific but leave much room for independent approaches. In the lectures background and motivating material and a certain degree of guidance for the experiments will be given; but the exact experimental set-up or diagrams will not be given. This is the responsibility of the student. The instructor (or the T.A. of the laboratory session) may give a moderate degree of specific guidance, mainly by asking the student pertinent questions to direct the student onto a correct path. He will do this only after the student has demonstrated substantial serious effort to solve the problem. The student should not expect to receive from the lab instructor exact circuit diagrams. The instructor will, however, point out errors in diagrams or hook-ups as far as this can reasonably be done. The grade given to the student for the experiment will partly depend on the degree of independence of the student. If everything else fails, the instructor will provide a good diagram, but this will be done at a severe penalty in the grading.

Contrary to popular belief, most of the work must be done by the student before he or she comes to the laboratory. One should study the problems using common sense and any required
textbooks and/or reference books. One must prepare a complete procedure for the experimental work including alternatives and must know what components and equipment are needed and allow for substitution if the first choice is not available. One must study the problem before coming to the laboratory so that the general trend of results is anticipated. This will make it possible to recognize "nonsense" results and correct the experimental procedure. Unnoticed wrong results will be considered worse than incomplete results in the grading, since the theory and the laboratory is available to the student to validate results. **For experiments involving circuit designs, SPICE simulations must be done in advance and .SCH files should be brought to the lab on a floppy disk** to be run on the PC's in the lab.

Each student must have an "electronics laboratory notebook". Ring binders and paper with square grid will be more convenient to use because computer printouts and graphs can be kept together with the hand written notes. The notebook will contain the preliminary work done as well as the complete work plan for the experiment including a list of components and equipment needed for work procedure (see Appendix B). It will also contain every test and check made, all in-lab computations, modifications of circuit or procedure, and results. The instructor may examine the notebook and grade the preliminary during the lab periods. In either case copy of the notes should be attached to the final report. SPICE circuit files (*.CIR or *.SCH) have to be submitted along with the electronic copies (*.doc MSWord and/or *.nb Mathematica) of the reports. The instructor will describe how and where to submit these electronic copies. (DO NOT send these large files through e-mail! E-mail accounts are not large enough to handle such attachments.) SPICE files, PROBE plots and any graph submitted must contain the names of both of the partners as well as the group number. Axes, units and multiple curves should be unambiguously labeled and the expected (or specified in design problems) values/curves/slopes etc. should be marked in color on the graphs for comparison and verification. A digital camera with floppy disk is available in the department. You may borrow it from the department’s office for recording important results (scope waveforms, for example) or for taking pictures of your circuits to attach in your notes and reports.

A concise, but complete, neatly prepared final report for each experiment by each member of the group must be handed in to the instructor within one week after the completion of the experiment. The title page of this report must show clearly the group number and all the names of the group members, the experiment number and title, and date (see Appendix C or the last page attached). It is expected that the circuits, design calculations and data to be the same for two reports written by the members of the same group. But, this cannot be used to justify near identical reports to be submitted. Particularly, discussions, comments, conclusions and the overall style should reflect individual contribution and originality. The report must be word processor printed. A good presentation is clear, concise, and informative. It makes good use of graphics, has good writing style and presents ideas in a nice logical sequence. The typical format of the report is given in Appendix A.

Some longer experiments will be allowed to be completed in two weeks. A quiz may be given at the beginning of each experiment. The instructor will give some overall guidance at the beginning. The work plans will be checked in the laboratory and graded.

In summary the students endeavors will include:
1. Preparation of work plans for each experiment based on independent reading and analysis, SPICE simulations and lecture suggestions.
2. Preparation for and taking of lab quizzes. (Note that preparation of a good work plan will aid in quiz preparation.
3. Conducting of the actual experiments in the laboratory.
4. Preparation of a Final Report for each experiment, including SPICE.
5. Simulations verifying the designs and the experimental results.

**Grading**

Grades will be assigned over the following categories with the indicated weights (approximately):

- Lab reports:
  - 25% Preliminary work/design
  - 50% Experiment and participation
  - 25% Discussions/Conclusions

NO LAB EXPERIMENT OR ITS REPORT MAY BE SKIPPED. Late reports lose 50% per week, compounded.

**Equipment Handling**

Never take for granted that the equipment or components are in good condition. Always check all equipment before you start the experiment. Make certain the power supply has ripple free output voltage and that the oscilloscope has the correct gain in the ranges of interest. Check all diodes and transistors with an ohm-meter. If in doubt, check with a curvetracer. Make sure resistors and potentiometers are close to the indicated value. Make sure that capacitors are not shorted, nor opened. In case of equipment failure, keep the malfunctioning equipment on your bench; do not swap equipment from other benches. Equipment sets are assigned to groups. Do not attempt to repair malfunctioning equipment. Do not even replace fuses. Call the lab instructor/T.A./technician for appropriate action.

**General Tips**

When something doesn't work as you expect, be skeptical about all facets of your design, fabrication and test of the circuit. Always be sure the circuit schematic is kept up to date as you make changes. Although test equipment may fail from time to time, problems are almost always due to errors in design, documentation or wiring; faulty components occasionally; or a misunderstanding of how to use the test equipment. In the laboratory the experimenter interacts with natural phenomena which tend to be brutally honest and unforgiving in evaluating a poorly thought out experiment.

Group interactions can be difficult; but Engineering is inherently a discipline requiring much team effort. Thus, the skills developed in working effectively in a grouped environment are quite
important. *It is the responsibility of each student to create an effective group where everyone contributes substantially.*
Appendix A

TYPICAL REPORT OUTLINE

The final reports are to be written as technical reports. They should be concise but should convey the experimental procedure and results clearly. You are writing your reports for an engineer with a general knowledge of electrical engineering. You must follow normal rules of grammar and composition in your reports. Your writing should illustrate the flow of rational thoughts which underlies the experimental endeavors you are describing. A typical report outline is given below:

1. Title Page (format given below)
2. Introduction and Objectives (just a few sentences)
3. Equipment/Software and components used
4. Procedure 1 (the experiment may be broken into separate procedures)
   a. Objective(s) for procedure (1-2 sentences)
   b. Step by step description of what was done including:
      (1) Diagrams and schematics of circuits designed and test procedures used.
      (2) Analysis and design procedures including SPICE simulations where applicable.
   c. Results for procedure 1. Use tables, graphs, and drawings to help organize and display your results.
5. Procedure 2 (where applicable)
   a. Objective(s)
   b. Step by step description of what was done. Here you may refer to previous procedures to avoid unnecessary repetition.
   c. Results
5. Procedure M
   
7. Discussion (for all procedures)
   a. Discuss the results and relate actual observations to theoretical expectations and SPICE simulations.
   b. Discuss and answer any special questions posed in the lab assignment handout.
Appendix B

TYPICAL PLAN OUTLINE

1. Summary of major procedures in the experiment.
2. Equipment and components required.
3. Procedure 1
   a. Goal for procedure (1-2 sentences)
   b. Designs and derivations required for procedure (with schematics)
   c. SPICE simulations
   d. Test setups required for procedure
   e. Description of measurements to be made and data to be taken
   f. Expected results
4. Procedure 2
   .
Group 4

ELE 342 Laboratory Report

on

MEASUREMENT OF B.J.T. CHARACTERISTICS

And

DETERMINATION OF SPICE PARAMETERS

By

Michael C. Johns

(proudly signed here by Michael)

Partners:

Alice K. Smith and John W. Williams

submitted to

Prof. M.G. Guvench

On

September 10, 2003