

EE 442

Preface  
1/12/2007

Laboratory Introduction

## I. INTRODUCTION

EE 442 labs have two primary objectives. First, they provide practical demonstrations of the basic concepts of electrical circuits taught in this course. Second, they provide an introduction to and practical experience with typical electronic measurement instruments used by electrical and computer engineers. EE 442 labs are held in 1208 Coover Hall.

## II. LABORATORY POLICIES

The lab grade comprises a percentage of the EE 442 course grade (as announced by the course instructor). The lab grade is derived from three components: pre-lab exercises, lab performance, and lab quizzes. The course or lab instructor will announce the relative weighting of each component. Include your name, section number, and lab bench number on all pre-lab exercises, lab summaries, and quizzes.

All labs have preliminary reading material containing pre-lab exercises. Pre-lab readings and exercises are important as they provide the “theoretical” answers to which the laboratory observations and values will be compared. Pre-lab exercises will be due at the beginning of the corresponding lab. Pre-labs will be graded on correctness and on the completeness of supporting work.

Each student is expected to actively participate in each lab experiment. Each student is encouraged to record all measurements and results individually in his/her own lab manual. These lab results will be consolidated into one brief lab summary for each team. This summary should contain answers to any questions posed in the lab exercise, a comparison of measured values with expected values (from the pre-lab), an analysis of why the observed values may have differed from the predicted values, and any other important results or conclusions you may have reached. The lab summary should be turned in at the end of the lab **before** the circuit is disconnected (to facilitate corrections if they are required). Lab performance grades will be based on the instructor’s observations of student preparation, participation, effort, and thoroughness as well as the measurement results, observations, and conclusions in the summary. A portion of the lab performance grade may also be based on the condition the students’ lab bench and work area is found after the lab.

Lab quizzes, approximately 10 to 15 minutes in length, will be given unannounced at the beginning of some lab periods. Quizzes may cover preliminary reading material and pre-lab exercises from the current lab as well as results, observations, and conclusions from previous labs.

**All labs must be completed to pass this course.** Students missing a scheduled lab due to an **unavoidable** circumstance should make every effort

to make-up the lab **during the week (two day period for summer labs) in which it was originally scheduled** by attending any later, regularly scheduled lab. If time permits, notify the instructor of the lab you want to attend of your request to make-up a lab. If you are unable to notify the lab instructor ahead of time, talk him/her immediately at the start of the lab period. If you are unable to attend a later lab, contact you lab instructor **as soon as possible** to arrange a make-up time. Make-ups for absences due to known circumstances (such as class field trips, etc.) must be arranged **before** the absence occurs.

### III. LABORATORY PRACTICES

Always work with a partner, and never alone. At least have someone working at a bench near by. If you have **any** doubt about the correctness or safety of **any** circuit or procedure, check with the lab instructor **before** proceeding.

**No food or drink is permitted in the laboratory.** After completing a lab, return all cables, connectors, and other components to their proper location. **PLEASE keep the lab area neat, clean, and safe.** At the conclusion of each lab period the lab instructor will check the entire laboratory including each lab bench. Points may be deducted from the performance grades for those lab teams failing to leave their area in a neat and orderly fashion.

### IV. EQUIPMENT LIST:

The components kit, to be used one per lab bench, contains the following:

Plastic Components Kit Box	
Resistors, 5% tolerance, 1/4 W (Note: See lab 3 for resistor codes)	
300 $\Omega$	1
1 k $\Omega$	2
4.7 k $\Omega$	1
10 k $\Omega$	4
15 k $\Omega$	1
33 k $\Omega$	1
100 k $\Omega$	2
Resistors, 10% tolerance, 2 W	
82 $\Omega$	1
1 k $\Omega$	1
22 k $\Omega$	1
100 k $\Omega$	1
Capacitors	
47 $\mu$ F (50 V)	1
0.1 $\mu$ F	1
0.01 $\mu$ F	1

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0.001 $\mu$ F	1
Potentiometers	
100 k $\Omega$	1
1 M $\Omega$	1
Miscellaneous	
Operational Amplifier LM 741	2
Transistor 2N2222	1
Diode 1N4007	3
Solderless Breadboard (Super Strip)	1

At the end of each lab bench is a rack containing various test and connecting leads. An LCR meter for accurately measuring inductance, capacitance, and resistance values is located on a cart just inside the northern-most door to the lab. A stapler is at the wall near the LCR meter.

The super strip will be used to build circuits in this lab. The super strip electrically connects together component leads and wires that are plugged into a common set of contacts (holes). In the center two groupings of contacts, the rows are numbered from 1 through 63; the columns are lettered a through j. The five contacts 1a, 1b, 1c, 1d, and 1e are electrically connected, forming a (distributed) node. The five contacts 1f, 1g, 1h, 1i, and 1j are also electrically connected, forming a node, but are not connected to the 1a – 1e group. The pattern continues throughout the remainder of the two central sections of the super strip; i.e., contacts 2a – 2e form a node (not connected to any other) through contacts 63f – 63j, which form the final separate node. Thus, there are 126 separate, five-contact nodes, half on each side of the middle groove of the super strip. There are also four (unmarked) columns of contacts, two on each side of the super strip. Although each column appears to be divided into groupings of five contacts, **all** of the contacts in one column are electrically connected together. Each column forms a continuous bus that can be used for one power supply voltage (such as +12 V) or as a ground (0 V), ect.

To plug a wire into the super strip, first, remove about 1/4 inch ( $\approx$ 5 mm) of insulation from a wire of appropriate size. This amount of removed insulation is optimal to prevent insulation from being jammed into the contact hole (too little insulation removed) while preventing wires from shorting together (too much insulation removed). Suitable wire and wire strippers are stored in the equipment cabinet and can be obtained through the lab instructor. Several leads found in the rack at the end of each lab bench have also been prepared for use with the breadboards.

Next, insert the bare end(s) of the wire(s) into their appropriate contact hole(s). Do not try to insert more than one lead or wire into one hole on the super strip. The contacts within the super strip use spring pressure to make contact with the wire. Attempting to insert more than one wire into a hole or trying to insert a wire that is too large will bend the contacts and result in a

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poor connection the next time the hole is used. If a wire ever becomes kinked, use a needle nosed pliers to straighten it or cut off the damaged end and re-strip the wire. Do not try to insert a kinked wire into the super strip. (Please do not cut off and re-strip the cables found at the end of the lab bench. If there are problems with these cables, report them to you lab instructor.)

When wiring your super strip, it pays to keep your wiring neat and flat against the board. This method keeps the wires from accidentally getting knocked out and makes your circuit a lot easier to check and debug. Although any wiring colors can be used, generally ground is indicated with a black wire and the positive DC power supply voltage is indicated with red. If a second (negative) power supply voltage is used (e.g., - 12 V), blue is often used, if available. Yellow is often used for a second positive voltage.

**V. PRELAB QUESTIONS:**

1. What are the primary objectives of completing the EE 442 labs?
2. What is the most import consideration in the EE 442 lab?
3. What colors are normally used for wiring? (For example, what colors would be used to denote a positive or a negative voltage?)