Engineering Laboratory Reports Manual

John B. Gilmer Jr.

Wilkes University
Wilkes-Barre, Pennsylvania

Wilkes University
84 West South Street
Wilkes-Barre, PA 18766

This book was developed for students in the engineering programs at Wilkes University. Those students may make use of sections of this book or its online equivalent in any manner consistent with their educational needs. This book is dedicated to those students, and those in the past, whose hard work and enthusiasm in the laboratory were an inspiration to the development of this document.

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Contents

Forward

This manual reflects an effort to bring up to date and expand the "Engineering Laboratory Reports Manual" which was first developed during the summer of 2008. After seeing the deficiencies noted on their laboratory reports in EE252, Electronics 2, students responded, "We don't know how to write a (good) laboratory report." They were right. The Little, Brown Book (Wilkes University's writing reference) addresses writing in general very well. But for discipline specific writing, especially for advanced classes with big projects, support has been inadequate. Laboratory manuals, where they exist as such, typically address the substance of lab exercises to be done, without much help beyond an example laboratory report that is often used as a template by students. Laboratory manuals do not typically contain anything such as advice on how to deal with surprises, or even mechanical issues such as how to port graphics into a report in an effective manner. Telling students, "You should be able to figure this out," was not an adequate strategy.

The first draft of this manual was developed as an emergency response to this issue. It helped. While first motivated by issues particular to upper level EE courses, the manual has also been used in EGR222 Mechatronics and EE283 Measurement Lab, taken by both EE and ME students. But that first draft was limited and deficient in numerous aspects, and has become dated. The opportunity of a sabbatical was used to revise the document and make the contents more suitable for web access. Wilkes University is committed to "Writing Across the Curriculum." This revised manual is specifically aimed at helping make that a reality within the engineering disciplines.

Writing is one of the most important things engineers do. There was a time when a newly graduated engineer would be put in a back office to grind out equations for resistor tolerances or other activities once called "grunt work." Only experienced engineers were promoted to positions involving communication with vendors and clients. Some never did, but continued to toil at back room work. Those jobs are gone. As computers have taken over many of the rote calculations, search, and statistical roles, newly graduated engineers need to be effective communicators from the beginning of employment. They will be interacting with clients to take vague, poorly defined descriptions of problems or tasks, and articulate them clearly and formally as the basis for a contract and a project that meets the client's needs. Most of that communication takes place in writing.

Furthermore, writing is an essential tool for understanding. The discipline of articulating a problem or the functioning of a system draws on mental resources that lead to greater understanding of the system and possible solutions to problems. This is particularly important in an educational setting. I have seen that students who are unable to use the right preposition, for example, current through a component, or Voltage across a component, typically also lack a clear understanding of the scientific and engineering principles involved. There is a critical relationship between the correct use of technical language and learning the principles critical to the discipline, rather than rote responses and methods. A lack of understanding principles, as manifest by poor usage in technical communication, will betray someone as technically naïve or incompetent in the professional world.

The nature of the laboratory experience is an important distinctive feature at Wilkes. At Wilkes, professors teach the laboratories. That means that laboratory exercises can be more open ended. Students can be asked to “design it your way,” with several degrees of freedom, or even their unique choice of circuit configuration. Examples include the power amplifier and radio laboratory exercises for EE252 Electronics 2 and the seven segment display lab exercise in EE241 Digital Design, for which every student’s code is unique. It takes considerable experience to help students through the process of diagnosing what went wrong when each student’s project is different. (Students are very inventive at devising errors; I get surprises too.) More is learned by trying things and hitting errors, and then making corrections, than by getting everything right the first time. We encourage this, and our students gain insight from it. But, how do you write a lab report where something has gone wrong? Electronics 2 Lab reports can run about 20 pages. That’s what it takes to describe the design process, simulation and lab results, and reach conclusions about what it means. A report is necessarily more involved if a discrepancy between design and performance needs to be explained. Students need help in doing this well. This manual is my earnest effort to help them do so.

Many people have helped with this effort. I appreciate the support of then Chair Dave Cary and Dean William Hudson in their support of my proposal for this endeavor, as well as the support of Mike Duffy, Mark Kuzawinski, Russel Stolins, Robert Taylor in that application. I appreciate opportunity to carry out this work granted by the Wilkes University Faculty Development Committee, chaired by Adam VanWert, and the Provost, Anne Skleder. Several colleagues and reviewers have been particularly helpful, and I would like to cite Mark Kuzawinski, Ed Mohring, and Ed Bednarz. Finally, I would like to thank my colleagues in engineering at Wilkes and our students, many of whom have contributed materials used in this manual.