

## **AN INTEGRATED WEB SITE FOR A DIGITAL LOGIC DESIGN LABORATORY**

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### **INTRODUCTION**

A web site providing on-line materials for a freshman level digital logic design laboratory in electrical and computer engineering is presented. The web site is designed to integrate the laboratory program with other components of the digital logic class, such as the lecture and on-line testing materials. The class web site provides laboratory content to 130-180 engineering and computer science students each semester. Laboratory materials are encoded in Adobe portable document file format and are provided on a weekly basis. The web site provides a mechanism of integration between the lecture and laboratory in a manner not possible by traditional publishing means.

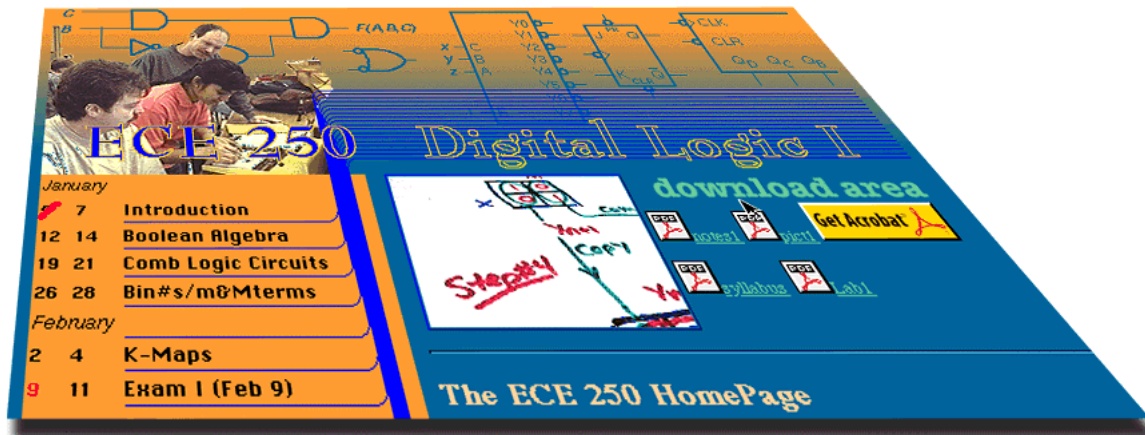


### **PAINTING NEW VISTAS WITH ON-LINE MATERIALS**

The advent of on-line lecture and laboratory materials for university courses has radically changed the type and scope of course materials that students may now obtain for their classes. These web-based publishing mechanisms have also opened up new vistas for new and innovative course content creation not possible through traditional means. No longer are students limited to information provided by prepared textbooks and laboratory

manuals. Streaming media tools such as digital video (DV), not possible with traditional paper publishing methods can now readily deployed over the web. Using on-line tools, instructors have also new additional time-use capabilities to prepare and distribute class materials before as well as during the class semester. The flexibility to change and enhance laboratory exercises in "real-time" is especially useful in cases where new equipment or software is introduced and procedures need to be readily updated.

In our example, a web site providing on-line materials for a freshman level digital logic design course by the Department of Electrical Engineering at Western Michigan University is described. Currently, the web site

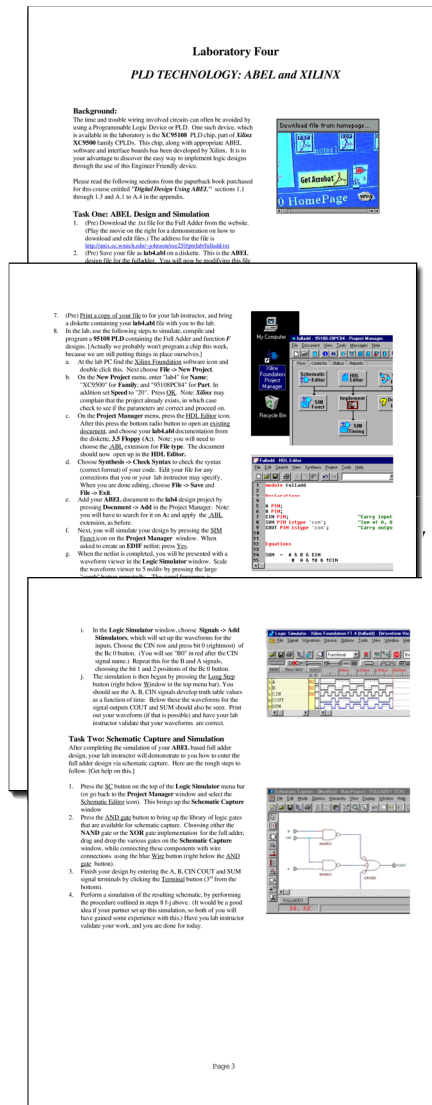


<http://www.unix.cc.wmich.edu/~johnson/ece250/> provides a number of support elements associated with the lecture and laboratory programs, including a calendar, a "download area", and on-line quizzes (not shown) as seen in the active web page graphic above. In the early years of the web site (1995), the laboratory program materials were distributed by traditional means, employing a laboratory manual, which the students purchased from a photocopy store. Starting with the fall of 1997, however, the lab exercises were encoded into Acrobat pdf format (detailed later) and presented alongside the class lecture notes as buttons in the "download area" of the web site. While the lecture outlines were available in 6-week chunks, the lab exercises were made available only on a week to week basis. This arrangement allowed us to insert DV training clips in the laboratory pdf documents (occasionally) which helped students with such procedures as writing laboratory exercises or downloading sample Altera logic design software code. The freshman undergraduates in electrical, computer engineering and computer science populating the course found the training videos to be very useful. Since the winter of 1998, we have been constantly modifying the on-line lab manual as a result of migrating to the Xilinx [1] logic design development system. Because of the complexity of the Xilinx system, we decided to change the laboratory exercises in an incremental manner, week by week, rather than in semester chunks. The flexibility to change procedures weekly makes good use of time and allows us to strengthen the laboratory with creative and innovative materials such as DV in a manner not possible before.

# EMPLOYING ADOBE'S VENERABLE PDF FORMAT

In order to make the on-line lab exercise documents effective, the text and graphics must be formatted in the same manner as found in traditional lab manuals. To achieve this, the laboratory materials are encoded in Adobe's portable document file (pdf) format [2], which gives the "look and feel" of a formatted word-processed document, while providing

file compression suitable for the web. The pdf format, although only four years old, has become the universal standard in on-line formatted publishing. Pdfs also share some of the standard document linking attributes found in html as well as a few advanced features as well, such as DV streaming. The laboratory exercise depicted at left give examples of the text and graphic formatting, web links and DV streaming possible in a pdf document. [Note that the lab document shown at left is a "live" document with active links that can be viewed by zooming in.]



Finally, let's describe the process required to fabricate this example. First, the text and Xilinx graphics were placed in a Microsoft Word document. All links were underlined in blue. Next, a postscript (ps) file was prepared for this document. (Its best to use AdobePS from their web site, but PDFWriter will work.) Then the ps file was encoded to a pdf file by using the Distiller program from Acrobat. Then starting Acrobat's Exchange, the blue links were encoded and the DV clip was inserted to complete the lab pdf. To generate the ASEE paper graphic on this page, I rasterized the pdf lab exercise to 300 dpi (unfortunately, Word does not retain eps or pdf; use Adobe Pagemaker instead of Word if you are able) and placed it, generated ps and made a pdf document. Using Exchange, I made the links and was done.

## ACKNOWLEDGEMENTS

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## REFERENCES

- [1]. "The Practical Xilinx Designer Lab Book", by Dave Van den Bout, Prentice Hall, 1998.
- [2]. "Publishing Via PDF", Special Pull-out, *Computer Arts*, December 1998, Issue 26.