

Using the Internet as a Course Textbook

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Abstract

This paper describes the creation and use of an online textbook for a course in Electronics Manufacturing. This project originated when no appropriate textbook could be found in print for EET 360: CIMT in Electronics Manufacturing. Creating an online textbook in this area was possible because of the plethora of information available on the web about electronics manufacturing. Trade magazines and vendors provide a wide variety of up-to-date and in depth information, all presented in easily accessible formats. Another advantage is that students received current, up-to-date information; no printed text could stay as current. In addition to receiving the necessary information for the course, students gained life-long learning skills.

The authors created the course text by constructing web pages for each lecture using OnCourse, an Internet development platform. Each lesson page included objectives, course notes, a list of resources and hyperlinks to required and supplemental readings, and questions or other assignments. Using this format, the faculty could focus the students on the key issues and direct students to web sites that were credible. Students were able to submit most assignments electronically.

Although this course still required class meetings for laboratory experiences, some laboratory simulation tools are also available over the Internet or available for download. In the future, methods can be implemented to make this course accessible to distance learners.

Introduction

EET 360: CIMT in Electronics Manufacturing is a junior/senior elective designed to give students a broad understanding of the processes involved in producing electronic circuit boards and electronics assemblies. Lectures begin with component fabrication and selection, electronic design and analysis, and printed circuit board fabrication. Through-hole and surface mount technology assembly are studied. Students are required to write a series of short papers on material covered in class. In the laboratory, students tour facilities involved in electronics manufacturing, and learn to use various pieces of manufacturing equipment. There are three semester team projects: a circuit board layout, complete with bill of materials; a production line specification, in which students select equipment for a SMT line and present their line to industry representatives; and an actual build, when a local manufacturer opens its floor to the class to run the equipment and produce product.

There was no text book available for this class, although many handbooks and periodicals did exist. Students were frustrated when their only reference material was the lecture notes. The authors compiled a selection of articles and distributed it to students in the form of course notes, but the compilation lacked the clear step-by-step focus of text books. Handbooks designed for industry use do a good job covering all the material, but were found to assume a level of knowledge of the industry that students didn't have. Printed matter, although useful, could not keep up with the rapidly changing industry. The goal was to create a resource for students to help them learn to research topics on their own, while supplying a direction and focus to avoid getting lost on the Internet.

OnCourse

OnCourse is a password protected framework for classroom activity to occur over the web. The software requires no knowledge of HTML or web publishing and is user friendly for students and faculty. Course space is automatically created and can be filled with content, syllabus information, tutorials, and links. Tools are provided to distribute, accept and grade assignments, and conduct tests and surveys with a variety of question types. OnCourse contains chat rooms and bulletin boards that students can use to communicate with each other. Participants have the

Fall 2000 [krc d1] EET 350 C244 CIM IN ELECTRONICE MANUFACTURING		Schedule
Lesson 10: Materials / Solder Paste	Lecture Notes	
Lesson 11: Printing (lab: vision / printing)	Lecture Notes	Oct 3, 2000
Test 1 Makeup	Semester assignment	Oct 10, 2000
SMT Magazine Article on Placement	Information	
Lesson 12: Placement	Lecture Notes	
Lessons 13 & 14 Heat Transfer and Reflow Soldering	Lecture Notes	
Lesson 15: Thermal Profiling with Lab	Lecture Notes	Oct 19, 2000
Lesson 16: ESD	Lecture Notes	
Lesson 17: Wave Soldering With Lab	Lecture Notes	Oct 26, 2000
Steps to assembly for a mixed technology board	Lecture Notes	
Jira Specification	Semester assignment	Nov 28, 2000
Lesson 18: Exam 2 / Jira specification assignemnt	Lecture Notes	
Lesson 19: Cleaning & Cleanliness Testing	Lecture Notes	Nov 9, 2000
Lesson 20: Inspection and Test	Lecture Notes	
Lesson 21: Conformal Coating and Mechanical Assembly	Lecture Notes	
Lesson 22: Rework and Repair	Lecture Notes	
Lesson 23: SPC	Lecture Notes	Nov 21, 2000
Production Run Group Assignments (Lessons 24 & 25)	Semester assignment	Nov 21, 2000
Final Exam due Friday 5:30 pm.	FINAL EXAM	Dec 15, 2000

Reload Page

Figure 1: Syllabus as presented to students in OnCourse

ability to post information onto the web using Oncourse and can store bookmarks and files within the program.

The most important tool used for this project was the “Schedule.” (See Figure 1.) This allowed content to be presented in a sequential manner. Items could include text, HTML, and attachments, or could link to another web page. The instructors used the schedule to post lecture notes, assignments, and class meeting information. Students recognized it as the central depository for all course information.

On-line Text Description

The ‘text’ for EET 360 consisted of one main web page per lecture. The use of OnCourse allowed a setup where a student could select “Schedule” and view a main textbook page (similar to a Table of Contents), from which s/he could select a desired lecture or lab topic (Figure 1). The layout of each page included (see Figure 2):

Objectives:

A list of specific student requirements for each lecture.

Notes:

Links to Power Point slides (when available), outlines of lecture notes, and/or images from overheads or slides. Outlines were sometimes supplied rather than complete slide presentations to prevent hundreds of pages from being printed unnecessarily.

Resources:

Links to periodical articles, industry organizations, manufacturers that related to the lecture/lab topic.

Assignment:

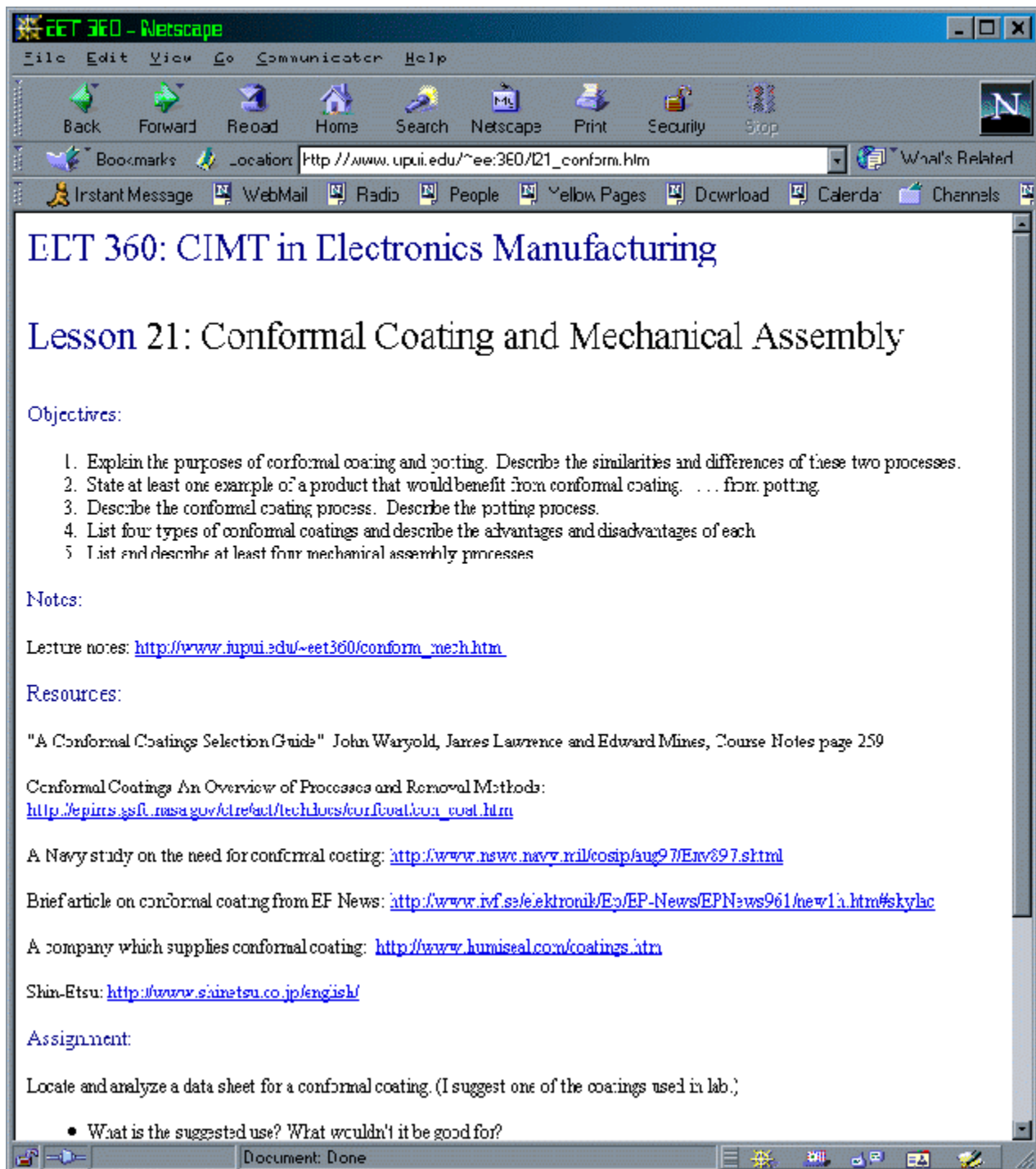
Any lab or homework assignments were listed here. The due date would display on the main textbook page next to the link to the topic (see figure 1).

References:

List of references that the instructors used to assemble the notes.

Inside OnCourse, links to the World Wide Web allowed for informational pages, such as maps & directions to offsite labs and tours, links to periodicals and organizations, images, and programs (shareware) which could be downloaded by the students.

The main advantage to this structure was that the instructors could present the information they felt was most relevant while requiring the students to develop or improve skills of seeking information required in lifelong learning. Students were presented with clear objectives by which to measure their knowledge of the material and with which to focus their reading.



EET 360 - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Stop

Location: http://www.upui.edu/~ee:360/L21_conform.htm What's Related

Instant Message WebMail Radio People Yellow Pages Download Calendar Channels

EET 360: CIMT in Electronics Manufacturing

Lesson 21: Conformal Coating and Mechanical Assembly

Objectives:

1. Explain the purposes of conformal coating and potting. Describe the similarities and differences of these two processes.
2. State at least one example of a product that would benefit from conformal coating. . . . from potting
3. Describe the conformal coating process. Describe the potting process.
4. List four types of conformal coatings and describe the advantages and disadvantages of each
5. List and describe at least four mechanical assembly processes

Notes:

Lecture notes: http://www.upui.edu/~eet360/conform_mech.htm

Resources:

"A Conformal Coatings Selection Guide" John Waryold, James Lawrence and Edward Mines, Course Notes page 259

Conformal Coatings An Overview of Processes and Removal Methods:
http://epitms.ssf.nasa.gov/crefact/techdocs/conformal_coat.htm

A Navy study on the need for conformal coating: <http://www.nswc.navy.mil/cosip/Aug97/Env297.shtml>

Brief article on conformal coating from EF News: <http://www.rvf.se/elektronik/Ep/EP-News/EPNews961/new1a.htm#skylac>

A company which supplies conformal coating: <http://www.kumiseal.com/coatings.htm>

Shin-Etsu: <http://www.shinetsu.co.jp/english/>

Assignment:

Locate and analyze a data sheet for a conformal coating. (I suggest one of the coatings used in lab.)

- What is the suggested use? What wouldn't it be good for?

Document: Done

Figure 2: Example Lecture Note Slide ²

Material presented in the lecture was reviewed, highlighting key points. The “Resources” section supplied one portal to link or locate recommended reading material. And since the text was “electronic,” the latest breaking industry news could be included in the course material.

The main disadvantage was the amount of time required to maintain this site. Not only did the instructors have to prepare lecture notes, but then they had to be prepared for the Web. Notes that were adequate for the instructor to lecture from had to be augmented so others could read them and understand the main points. Graphics that took a minute to draw on the board would take an hour to create for publishing. Searching for the sites with quality, relevant material sometimes seduced the instructors to get lost in the Internet. Known sites had to be verified, changes in URLs and content monitored, and links corrected. For the most part, these disadvantages are the same for any course significantly utilizing the Internet.

Conclusions

Students who used the on-line text typically did better on exams than those who relied solely on lecture notes. Though this is no surprise, it does demonstrate that the students did not waste the time spent viewing the lecture pages. However, not much paper was saved: students would print out every lecture page, slide and article to carry around and use the same way as a printed text. It appears students are still more comfortable with the traditional paper text. Perhaps this will change as more students get more powerful, portable computers.

Overall, on-line texts could be the direction of textbooks in the future. Whether or not the Internet can replace printed texts remains to be seen; however, the Internet offers a tremendous opportunity to present supplemental material in a very organized way - much improved over large piles of paper handouts.

The demand for a course specifically in Electronics Manufacturing is driving the development of this course into a totally online course. Industry would like courses such as this, however, business is such that it is difficult for employees to leave the workplace and visit campus, and it can be difficult to design and present courses off campus. While there are still hills to climb (such as hands-on laboratory experiences), the creation of an online text is a big step in this direction.

Bibliography

1. OnCourse Homepage, Copyright 1999-2000, The Trustees of Indiana University
URL: <http://www.oncourse.iupui.edu>
2. Cooney, Elaine EET 360 Lesson 21: Conformal Coating and Mechanical Assembly
URL: http://www.iupui.edu/~eet360/121_conform.htm

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Kenneth Reid is an Assistant Professor in Electrical Engineering. He has a BS degree in Computer and Electrical Engineering from Purdue University, and an MSEE from Rose-Hulman Institute of Technology. He is currently working to implement advanced digital design techniques into early digital courses, electronics manufacturing, and implementing different learning and teaching styles in the classroom.

ELAINE COONEY

Elaine Cooney is an Associate Professor of Electrical Engineering Technology. She received her BSEE from General Motors Institute and MSEE from Purdue University in West Lafayette, IN. Her areas of expertise include electronics manufacturing and test engineering. Her current focus is to provide experiences for distance education students.