Use of WebCT in Delivering Instructions in Engineering

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Abstract

In recent years, the web more than any other tool has been utilized in many colleges and universities across the nation and around the world to extend the educational reach of institutions and to enhance the quality of instructions. In the Engineering Studies Program at Georgia Southern University, WebCT was used during the fall semester of 2000 as the primary tool to complement and enhance a freshman level course entitled "Computing for Engineers". In this course WebCT created a convenient and effective environment for instructor-student interaction. Using WebCT, the instructor was able to provide the students with a variety of course related material to aid them in better understanding the topics covered. The course documents were created using a wide range of software tools and made available for the students through WebCT in the PDF format. Electronic submissions of student assignments provided an opportunity for the instructor to take a closer look at the details of the student projects and grade them with greater accuracy. The assignment grades were reported back to the students confidentially via the web to help them keep track of their records and progress. An electronic bulletin board in WebCT allowed the instructor to provide the students with continuous support and guidance outside the classroom environment. The paper presented provides details in regards to the structure and components of the environment created within WebCT for teaching this computing course. The details will clarify how these components were utilized to achieve the specific objectives of this course. Use of various other beneficial tools available within WebCT will also be illustrated to show how these tools can be employed to further enhance the teaching effectiveness of the instructor.

I. Introduction

In the paper presented details for utilization of WebCT in teaching a course entitled as Computing for Engineers (ENGR 1132) are provided. This course in taught at the freshman level in the Engineering Studies Program at Georgia Southern University. Through this program the students finish the first two years of their engineering education at Georgia Southern prior to transferring to Georgia Tech to complete the rest of their degree requirements. The intent of the ENGR 1132 course is mainly to introduce the students to the basics of computing and programming principles, and to teach them how to utilize a variety of different software tools and packages. All the lab assignments performed in this course basically had two main components; one component dealing with the computing and programming principles, and the other dealing with the utilization of a particular software package. One sample lab project which was assigned to the students in a three-hour lab is provided in Figures 1 - 3. This project is presented to illustrate an example of the

type of exercises the students had to perform and submit for grading in this course. In the first part of the project, the students were expected to perform a few exercises from their course text[1] related to the computing and programming principles. In the second part of the project, three problems were assigned mainly to test the students' abilities in utilizing various features available in the Excel software package. This part of the assignment involved performing the following activities: creating and utilizing various Excel formulas and functions; creating various charts; embellishing spreadsheets and charts; and utilizing various other useful features in Excel. In designing these problems several engineering textbooks were consulted[2,3]. These problems were selected not only to teach the students about the specific course topics, but also to introduce them to other engineering and mathematical principles. For example, the problem presented in Figure 2 was assigned to familiarize the students to the concept of buckling of columns; and the problems presented in Figures 3 and 4 were selected to illustrate how the given functions will appear when plotted using different scale types (log-log, semi-log, etc.).

In teaching two sections of the Computing for Engineers course in the fall semester of 2000, WebCT was utilized as a means to complement the instructor's in-class instructions, and to enhance the instructor-student interactions. The description of the various features of the WebCT and the particular manner in which these features were utilized in teaching the ENGR 1132 course are presented in the next section.

II. Course WebCT Tools and Components

Three screen snapshots of the course's WebCT site are provided in Figures 4 - 6 to illustrate some of various WebCT features and components that were utilized in teaching the Computing for Engineers course. Figure 4 shows the front-page of the course WebCT site as it was viewed by the students after they entered their "username" and "password". The page counter placed on this site indicates that the course WebCT site was accessed a total of 2665 times during the fall semester of 2000. The main area of the screen in Figure 4 illustrates the icons for utilizing the WebCT features discussed below:

(a) Bulletin Board – The instructor used this tool as an effective way to communicate with the students outside the classroom and during off-times. Occasional suggestions and hints for preparing student projects and solving the assigned problems were offered to the students on weekends as they were completing their projects in the computer lab. Electronic copies of the example programs discussed during the lectures were also posted on this bulletin board to give the student access to these important documents. By examining, manipulating, and running these programs, the students were able to enhance their understanding of the programming principle discussed during the lecture. The students' access to the posted files relieved the students from taking extensive notes during the lecture and enabled them to pay more attention to the subjects discussed.

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LAB # 6

Part 1 (Fortran Programs):

1. Exercises 4-22 on page 47 text.
2. Exercises 1-9 on page 58 text.

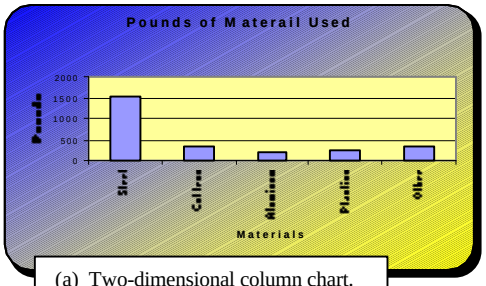
Part 2 (Excel):

Create the solution for the following exercises on successive pages of a single Excel spreadsheet, and provide the instructor with a hard copy and a soft copy of your work. The soft copy must be submitted through WebCT as usual. Use appropriate titles for the charts, and label all axes. Note that your personal informational should appear on all your sheets in the format discussed by the instructor. Also, use borders and gridlines on all your spreadsheets.

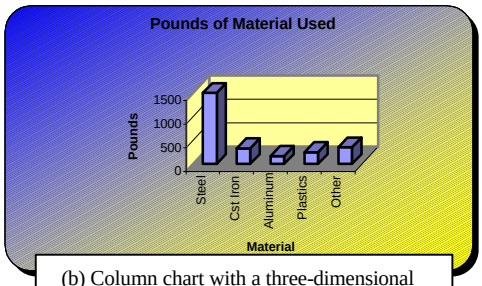
1. The materials used in a particular make of automobile area as follows:

Material	Pound
Steel	1500
Cast Iron	330
Aluminum	170
Plastic	250
Other	350

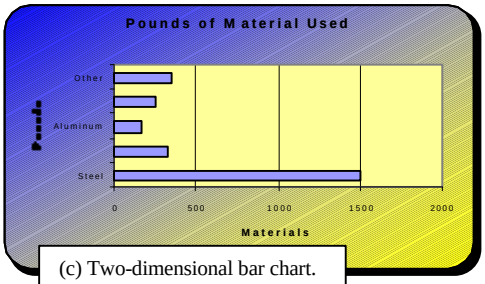
Plot this information using the following type of charts:



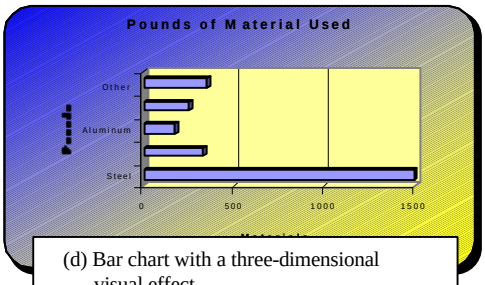
(a) Two-dimensional column chart.



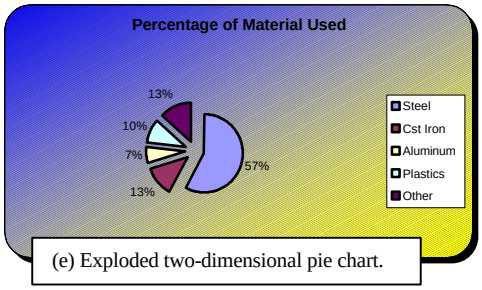
(b) Column chart with a three-dimensional visual effect.



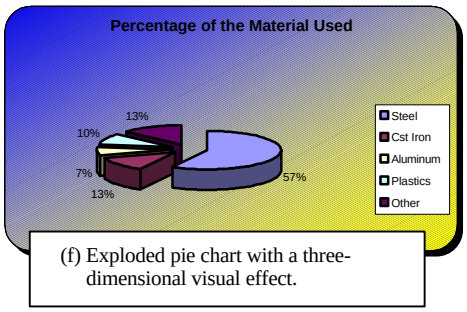
(c) Two-dimensional bar chart.



(d) Bar chart with a three-dimensional visual effect.



(e) Exploded two-dimensional pie chart.



(f) Exploded pie chart with a three-dimensional visual effect.

Figure 1. Sample Lab Project for the Computing for Engineers Course

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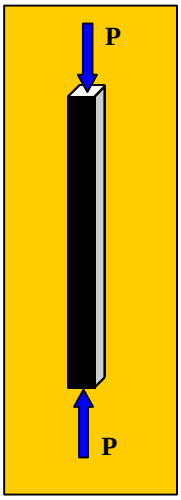
2. According to NFPA (National Forest Products Association) the allowable stress in short, intermediate and long timber columns having a rectangular cross sections are:

$$s_{allow} = 1.20\,ksi, \qquad when \quad 0 \le kL/d \le 11$$

$$s_{allow} = 1.20\left[1 - \frac{1}{3}\left(\frac{KL/d}{26.0}\right)^2\right], \qquad when\ 11 < kL/d \le 26$$

$$s_{allow} = \frac{540}{(kL/d)^2}, \qquad when\ 26 < kL/d \le 50$$



Where d is the smallest dimension of the cross section. Plot the allowable stress versus the kL/d ratio for the values of kL/d ranging from 0 to 50 as shown in the diagram. Use increments of 2 for the kL/d when plotting the stress function.

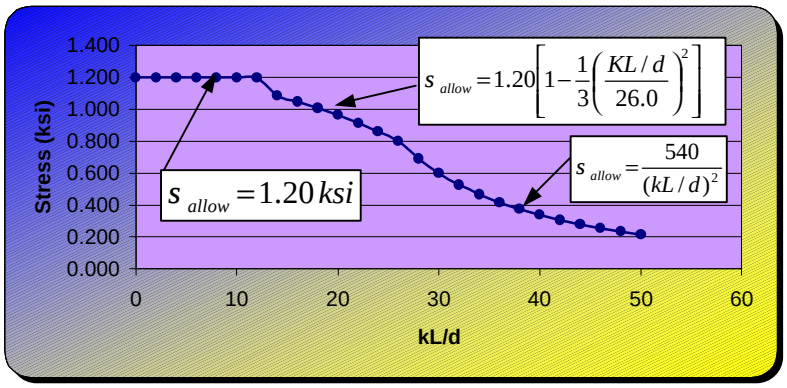


Figure 2. Sample Lab Project for the Computing for Engineers Course (Continued)

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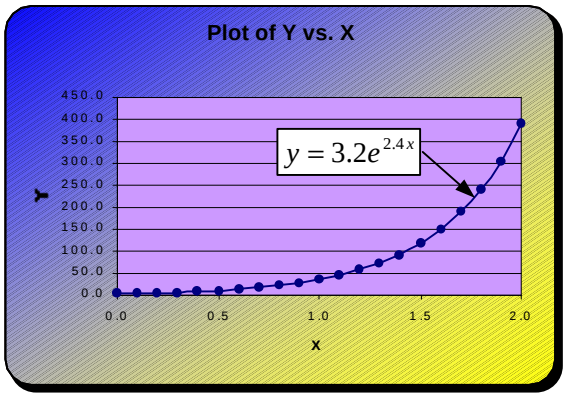
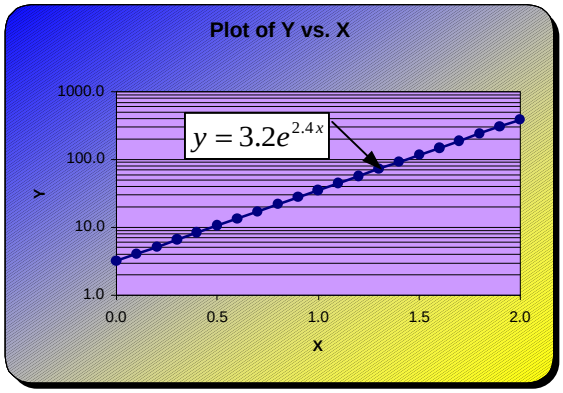
LAB # 6 – Continued

3. Plot the function $y = 3.2\ e^{2.4x}$ using the scales shown below for the range of x between 0 and 2. Use increments of 0.1 for x and show the spreadsheet and the charts on the same sheet.

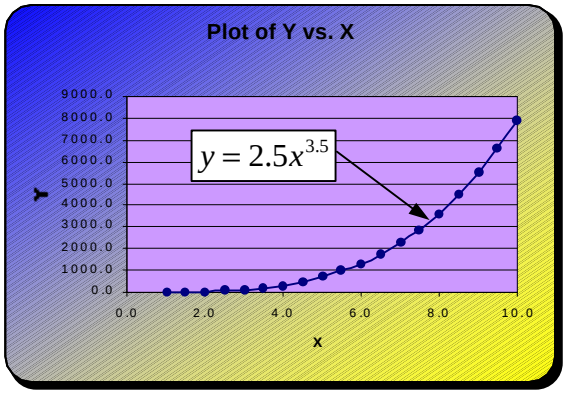
   (a) Regular scale along both the x and y directions.
   (b) Regular scale along the x direction and logarithmic scale along the y direction.





4. Plot the function $y = 2.5x^{3.5}$ using the scales shown below for the range of x between 1 and 10. Use increments of 0.5 for x and show the spreadsheet and the charts on the same sheet.

   (a) Regular scale along both the x and y directions.
   (b) Logarithmic scale along both the x and y directions.



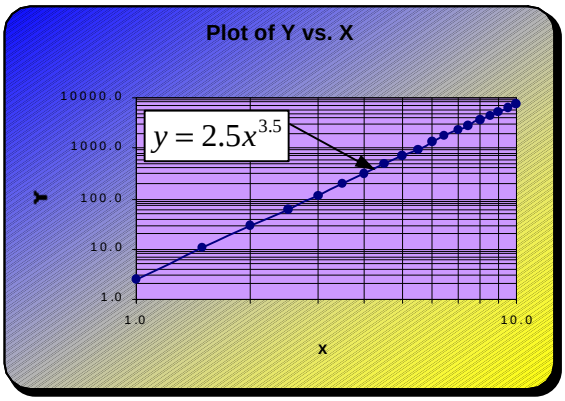


Figure 3. Sample Lab Project for the Computing for Engineers Course (Continued)

(b) Electronic Mail – Throughout the fall semester 2000, the students enrolled in the course were required to submit electronic copies of their completed lab projects through the use of WebCT for grading. Access to these electronic files allowed the instructor to be able to take a closer look at the details of the students' projects and evaluate them with greater accuracy. For example, in the sample project presented in Figure 2, the students were instructed to utilize a "nested IF" structure to compute the allowable stresses in a timber column for a series of values of "kL/d". When grading the projects, the instructor had the opportunity to click on the appropriate cell on the students' spreadsheets to determine if the requested "nested IF" structure was actually utilized, and if it was utilized in the correct form. All the submitted projects were archived in appropriately named folders and subfolders in an organized fashion for documentation purposes and for easier future referrals.

(c) Chat Rooms – The chatting feature of WebCT is another communication tool that the instructor can utilize to communicate with the students. This tool can be of particular interest to the instructors who are teaching "Distance Learning" courses, or instructors who have a large number of non-traditional students who cannot be physically present on campus. This feature is also valuable for instructors who themselves cannot be present on campus to hold regular office-hours. In these situations, the instructor by using the chat rooms in WebCT can hold "virtual" office hours, and effectively communicate with the students over the web. The chatting tool was not actually utilized in teaching the "Computing for Engineers" course mainly because of the nature of the course, and the type of the students enrolled in the course. Instructors should be aware that this feature of WebCT may possibly encourage some students to be less responsive in class (or try to skip class) knowing that they can seek help conveniently later through chat sessions.

(d) White Board – Using this WebCT tool, the instructor has the ability to sketch diagrams and place text on an electronic board to provide better explanation of the topics. This board can then be viewed on all students' computer screens. Using this feature, the instructor could also pose questions and ask students to respond to his/her questions by drawing on this board. Both the student and instructor's responses can be viewed by the entire class. This feature seems to be specifically very useful for the faculty who are teaching "Distant Learning" courses.

(e) Calendar – The instructor used this feature to provide the students with an electronic calendar of the course at the beginning of the semester. This calendar reminded the students about all the important dates and course events for the entire semester (project due dates, exam dates, lab schedule, etc.). Placing this information on the course WebCT site helped the students to be better prepared for the course events and to plan ahead.

(f) Student Grades – The course management capability of WebCT enabled the instructor to report the lab project grades back to the students in a quick, convenient, and confidential form during the fall semester of 2000. This feature also allowed the students to be able to

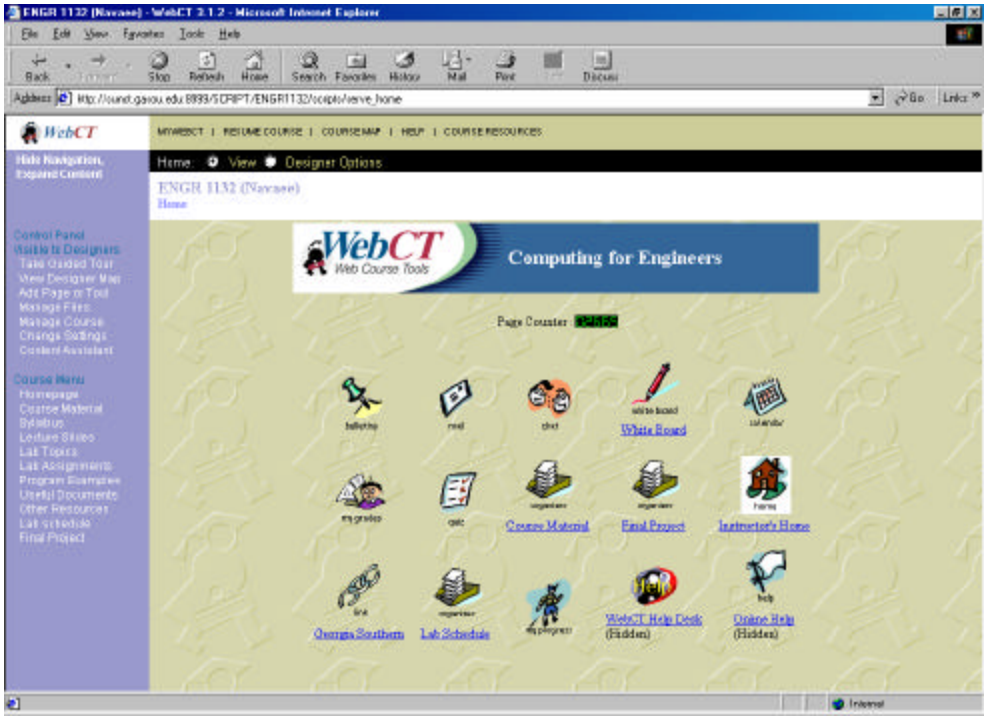


Figure 4. Snapshot of the Computer Screen Illustrating a Few of the WebCT Tools

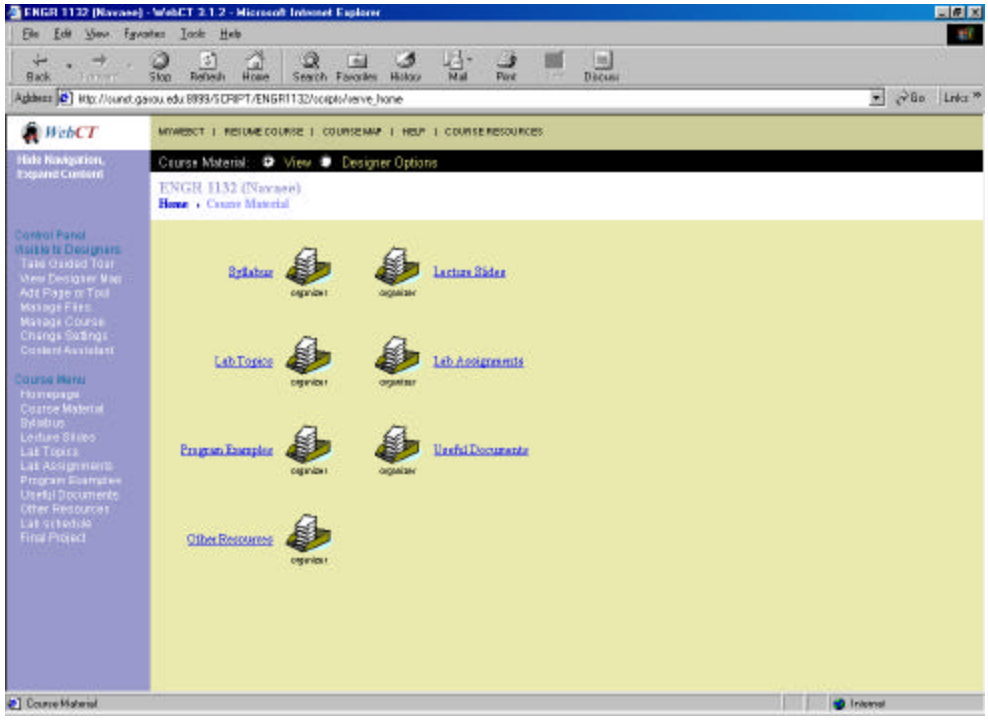


Figure 5. Snapshot of the Computer Screen Illustrating Various Course Components

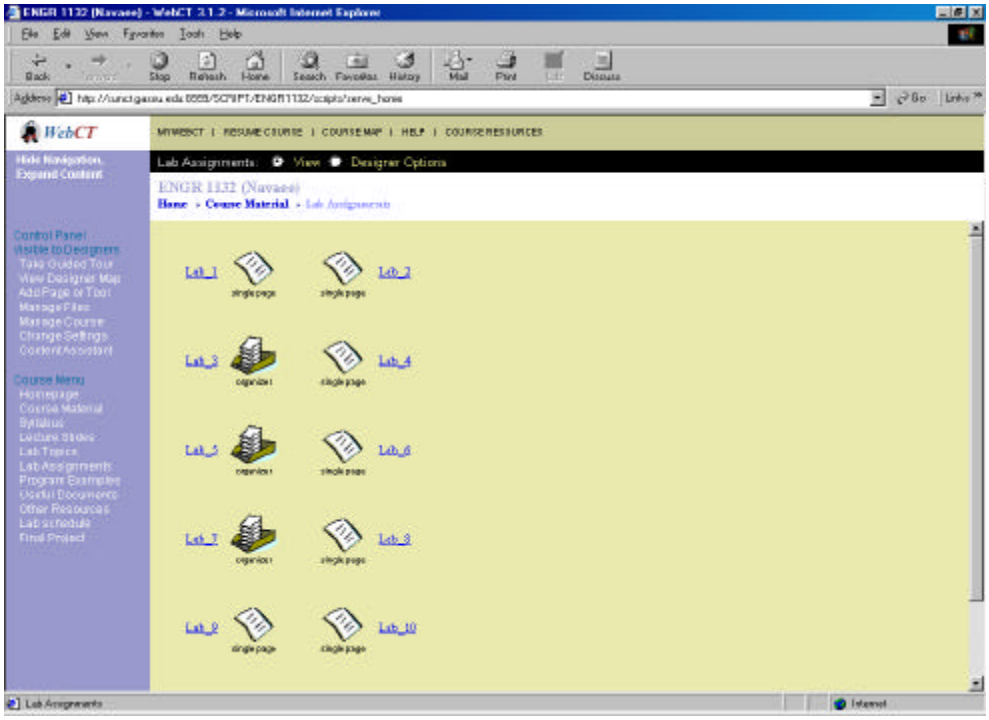


Figure 6. Sample WebCT Page Created for the Computing for Engineers Course

keep track of their records and monitor their own progress. Another useful feature of WebCT allows the instructors to be able to directly download student records over the web. At the end of fall semester 2000, the project grades were downloaded and directly imported into an Excel spreadsheet to determine the students' final course grades.

(g) Quizzes – A variety of quiz types can be designed and administered in WebCT. This capability of WebCT was not fully explored during the fall semester of 2000 due to the nature of the course, and also partially due to security issues. The electronic environment within WebCT makes the exchange of information between individual extremely easy.

(h) Course Material – By clicking on an "organizer" icon labeled as "Course Material" on the main page of the course WebCT shown in Figure 4, the students were given access to a variety of course related material as illustrated in Figure 5. The contents of this screen reveal that through this page the students can have access to documents such as course syllabus, lecture PowerPoint slides, lab assignments, program examples, as well as a few other files. All the different types of documents produced for this course were converted to the portable document format (PDF) files using the Acrobat Exchange software to allow the students easy and convenient access to these files. When converting the PowerPoint presentations to the PDF files, these document were created as "password protected". Using a special feature of the Acrobat Exchange software, this type of "password protected" PDF files can easily be created in a variety of formats.

The lecture PowerPoint slides for this course were basically created to complement the text and to aid the students in understanding the course material. These slides contained text, graphics, scanned images, as well as a limited number of animations. The slide presentation files were also utilized by the instructor during lectures to explain course topics and to clarify concepts.

The last snapshot from the course WebCT site shown in Figure 6 illustrates the format in which the course material was presented to the students. Icons labeled as "organizers" on this page served basically as folders that contained multiple related documents. To conclude this section of the paper, a summary of the most valuable and useful features of the WebCT is outlined below:

- Allows the instructor to easily create a web environment through which he/she can effectively interact with the students. Creation of a web site through using conventional authoring tools can be a very time consuming activity.
- Enables the students to access a wide variety of important course related documents easily and conveniently whenever they need it.
- Enables the instructor to conveniently share course information with other colleagues.
- Allows both the instructor and the students to be able to contact each other at any time from any location.
- Other communication tools in WebCT such as white boards and chat rooms further enhance the instructor-student interactions and provide a more user friendly and natural form of electronic communication.
- Electronic submission of the assignments through WebCT allows the instructor to be able to grade them with greater accuracy. Graded assignments can easily be archived in WebCT for possible future referrals.
- Assignment grades can be returned to the students quickly and conveniently in a confidential way, so that they can keep track of their records.
- Student course records in WebCT can be downloaded and imported into a spreadsheet package to allow the instructor to easily determine the students' final course grades.

III. Summary and Conclusion

In teaching the "Computing for Engineers" course during the fall semester of 2000, WebCT created an easy to use and convenient environment for the instructor and the students to interact. This electronic environment effectively enhanced the instructor's course delivery and elevated the students' course comprehension. A discussion about various specific WebCT tools and the manner in which these tools were utilized in teaching the course were included in this paper. The results achieved in this course were so encouraging that the author has decided to utilize the WebCT in teaching all of his courses in the spring semester of 2001. In this semester, the author is scheduled to teach one section of the "Computing for Engineers" as well as two sections of the "Engineering Graphics" course.

Bibliography
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