

# A professional Master degree on the Internet

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*Abstract*— This paper describes the online Master of Engineering Program (MEng) developed at the University of Illinois at Chicago. After introducing what a student experiences while taking an online class, the MEng program is introduced. At the end, some general considerations about the development of online programs are outlined.

## I. INTRODUCTION

The Internet was originally developed in 1969 for the U.S. military and gradually grew to include educational and research institutions. In the last five years, connections to and use of the Internet have mushroomed, linking millions of computers worldwide. Commercial industries, corporations, and home users all communicate over the Internet, sharing software, messages, and information. The most famous aspect of the Internet is the World Wide Web (WWW), a system of graphical files saved in a standard format known as Hypertext Markup Language (HTML). Today, users with a Web browser application installed on their computer can view text, graphics and photos, watch videos, listen to audio and music and interact with on screen elements. We refer to these components as multimedia files.

## II. MOTIVATIONS FOR ONLINE EDUCATION

Multimedia files are extremely helpful for educational purposes because concepts can now be conveyed using interactive videos, images and sounds, all features that cannot be found in an ordinary printed textbook. The interactive feature of the Internet and the fact that it is potentially available to everybody with a computer anywhere in the world, have attracted educational institutions to venture into the world of online education. Online education may be of particular interest to the following categories of potential students:

- Individuals at locations remote from university campuses;
- People who cannot take instruction in ordinary classrooms because of work, family obligations, travel, and scheduling conflicts; or

- Individuals who are temporarily or permanently disabled.

These potential students may have already heard about distance education, for example in courses where one can obtain a degree after studying instructional material, such as videotapes or books received by mail. However, they may be reluctant to consider this form of distance education because of the lack of interaction with the instructors. In contrast, education over the Internet offers plenty of opportunities for interaction with other students as well as with instructors, while providing multimedia educational material. With the Internet, distance is not an issue any more. In fact, thanks to worldwide computer networks, there is virtually no difference between communicating with somebody that sits in a nearby office and somebody who is connected to the Internet on the other side of the world. Communication with somebody over the Internet can be synchronous, such as with chat-rooms, or asynchronous, such as with emails. In the same way, online education can be synchronous or asynchronous. Synchronous education requires students and instructors to be in front of their computers all at the same time, similar to videoconference. Conversely, asynchronous education gives students the freedom to set their own pace within the time-constraints of deadlines to turn-in homework assignments or to take quizzes and examinations. Asynchronous online learning is especially beneficial for responsible individuals who desire to upgrade their professional skills and want to pursue an advanced degree without commuting to campus. Asynchronous online learning is not ideal for students pursuing an undergraduate degree (because undergraduate students usually have not yet developed enough self discipline) or those pursuing a degree that has a laboratory research component. From these considerations, it follows that Internet degree and certificate programs are well suited for Master level (post-bachelor) instruction, or for technical-level (associate degree) instruction.

Taking advantage of the capabilities of the Internet, the University of Illinois at Chicago has developed a

Master of Engineering (MEng) program over the Internet. This program takes full advantage of the Internet's multimedia elements and its communication tools and offers a valuable and comprehensive higher education learning experience. The Master of Engineering (MEng) program is primarily based on the asynchronous teaching model. To understand how easy and intuitive this method of learning is, we will briefly explain the MEng Program and illustrate how students take classes online for the MEng Program. We then will outline some of the administrative considerations in developing an online program.

### III. THE MASTER OF ENGINEERING DEGREE PROGRAM

([HTTP://WWW.UIC.EDU/ENG/MENG](http://www.uic.edu/eng/meng))

The College of Engineering of the University of Illinois at Chicago has offered the Master of Engineering Degree program since the Fall of 1999. The MEng is a professional degree program offered worldwide on the Internet. Based entirely on coursework, without a research component, the Master of Engineering degree is a very flexible program tailored to the educational needs of professional engineers. It is ideal for those who cannot attend courses because of geographical location, work or family obligations, or disability. Prospective students that meet certain admission criteria and have taken prerequisite classes are able to design their own curricula with the assistance of a faculty advisor. The only compulsory courses are: Engineering Law, Engineering Management and an Executive Seminar. The courses where students select from are listed in Table I are available.

### IV. TAKING AN ONLINE CLASS

To take an online class, a student must first register and take care of all the administrative and admission procedures for his/her enrollment (tuition and fees, degree requirements, course transfers, consultation with an advisor). Once enrolled in the program, students can access their classes at anytime and from anywhere in the world with a computer connected to the Internet and by going to the web address <http://courseinfo.uic.edu>. Very strict security measures are incorporated into the program so that only registered users can access the online course material. Each user is provided with a unique user login name and a corresponding password for login to a particular class. When a student logs in to a class they are enrolled in, they see the screen shown in Fig. 1, the class announcement page. This page keeps the students informed and up to date with what is going on with the class and sets the pace of the course. From this page, students learn when a new lecture is available, the date of a quiz or a homework assignment deadline. All announcements are prepared by the instructor or by the teaching assistant. The left part of Fig.1 shows the navigation buttons that represent the different actions the students can take.

A few examples and descriptions of the main actions available to the students are:

- Access lecture material by selecting the Course Document section. Lecture material can be presented in two ways: plain text or with multimedia elements such as audio, video, animation and interactive applets. Students also are given the choice of downloading and printing certain class materials or they can stream a lecture that contains sound or video images.
- Access the homework assignment or take an online test. There are mainly two types of online tests. The first type contains questions with multiple-choice answers. This type of online test provides a convenient way of receiving immediate feedback and self-evaluation. The second type of online tests is graded by the instructor and can contain essays or any other type of examination format.
- Contact with the instructor, the teaching assistant or other students is made possible by using various communications tools. Typically, students can use email or discussion boards. Discussion boards are visible to all students enrolled in a particular class and are useful for posting an explanation to a question of general interest.
- Access to student tools. Among the student tools there are:
  1. The "Digital Dropbox" used to submit a homework assignment and retrieve it after it has been graded or commented on by the instructor.
  2. The "Check Grade" function where a student can check his or her grades.

### V. CONSIDERATIONS FOR INSTRUCTORS

The instructor is responsible for the course content and material. Instructors have different options on how to prepare and present the course material. Those options are discussed in [1]. Other than the differences in preparation and presentation of material, online courses also have some distinct advantages over classroom teaching.

Instructors can track and follow each student's progress. As an example, instructors can see how many times a class lecture has been accessed and for how long. The instructor can access information regarding student participation and involvement in the class and even receive important feedback on how the instructor can improve upon his/her lecture content.

An instructor may decide to meet with all the students in an online course. Although the example in Section 4 above is an asynchronous online class, there always is available a virtual classroom that provides a facility for synchronous communications should there be a need for one. There students and faculty meet.

For faculty, online classes require significant initial effort to develop and produce a web class. However, once a class is produced, no additional time or effort is

required other than what is required in normal classroom teaching. Moreover, there are some distinct advantages to teaching online. The flexibility to contact students via email allows faculty to teach from anywhere in the world, for example, to attend a symposium without having to find a substitute lecturer. New faculty research findings can be easily incorporated onto the online course material and published immediately worldwide since it is all in digital format; faculty no longer have to wait for the printing press to update and publish their course materials. In addition, the higher quality level of the course material for an Internet course can serve as a good springboard to develop a textbook or Ebook on a CD with embedded multimedia elements.

## VI. FINANCIAL CONSIDERATIONS

Developing an Internet course for one semester class, i.e. the equivalent of 42 one-hour lectures, requires a lot of planning time and effort for the course creator. At the University of Illinois at Chicago, course creators are given one month of the summer to start preparing their course and are released from teaching one class during the first semester the web course is offered. The cost of developing one Internet course at the University of Illinois at Chicago is about \$60,000. Of the total cost, approximately \$30,000 is incurred by the College of Engineering to: \* Maintain and amortize the computer equipment used to develop and create the course; and \* Use the TV/audio studio for recording media elements, including the related technician's time. The remaining \$30,000 that must be generated from tuition and funding sources outside the College of Engineering represents the cost of: 1) The course creator's release time from teaching during the semester; 2) One month of summer salary for the course creator; and 3) One 50% teaching assistant for one year. The MEng program must be financially self-supporting and this is true for all Internet programs at the University of Illinois. The Board of Trustees has set tuition and fees at \$450 per credit hour for the MEng program (each MEng class carries 4 credit hours). The program becomes self-supporting with sixty or more enrolled students per semester.

## VII. BENEFITS AND STUDENT FEEDBACK FOR THE MENG ONLINE INSTRUCTION PROGRAM.

Students who have participated in the MEng program find the following benefits [2]:

- Flexibility in receiving instruction in terms of location, time and pace.
- Capability of reviewing the course material at their own pace, at anytime and as many times as they wish.
- Effectiveness of learning through the use of multimedia and interactive approaches.
- The incorporation of a quiz after each lecture, to provide immediate feedback on student compre-

hension.

Not only do students benefit from online courses, but universities who offer online classes increase their global visibility, i.e. now one doesn't need to reside in place X to attend school Y. Because of the Internet; Universities become worldwide learning forums.

## VIII. CAVEATS

Developing online courses present many challenges. First and foremost, it is usually difficult to motivate faculty to produce an Internet course because of the significant time commitment. Also, some instructors feel intimidated to jump onto the information revolution and prefer more traditional classroom instruction. In contrast, as we have seen, the new wave of students are by no means intimidated by the Internet and at times feel more comfortable with this medium. Second, it is also difficult to raise funds for the initial course production. Third, quality must be tightly controlled. For example, to ensure that the student taking the class is the one registered for the class, mid-term and final examinations are given at monitored testing sites. The identity of the students must be verified to avoid cheating. For international students, the MEng program solicits the aid of Universities and Embassies near the location of the student to conduct proctored examinations. Fourth, once a web course is prepared, it needs to be periodically upgraded for two reasons. Students may lose interest in it and it may become outdated quickly, especially in fields like engineering where research and development is moving at an alarming pace. Fifth, to support the program, adequate financial resources, a well-defined administrative structure, responsive customer service and excellent computer support must be in place.

## IX. CONCLUSION

The Internet has opened the pathway to online teaching, which has many advantages but at the same time, has also its own difficulties. Institutions interested in offering online classes should start any new program slowly and methodically. It is better to promise little but deliver, rather than to promise a lot and fall short because the academic reputation of the entire university is being projected worldwide.

## REFERENCES

- [1] Danilo Erricolo and Raymond T. Matthes. Web based instruction in engineering. *IEEE Antennas Propagat. Mag.*, 41(6):113–117, 1999.
- [2] S. S. Dang, R. A. Matthes, and C. G. Takoudis. A web-based course in chemical engineering. *Chem. Eng. Educ.*, 32:242–245, 2000.

TABLE I  
MENG TOPICAL AREAS

Chem. Eng.	Comp. Science	Electromagnetics	Energy Resources	MEMS	Wireless Comm.	Compulsory Courses
CHE 494	CS 474	ECE 401 ECE 423 ECE 520 ECE 526	ME 501	ECE 401 ECE 449	ECE 422 ECE 432 ECE 434 ECE 435 ECE 465 ECE 535	Engr. 400 Engr. Mgt. Exec. Sem.

1	ECE 401	Quasi static Electric and Magnetic Fields
2	ECE 422	Wave Propagation and Communication Links
3	ECE 423	Electromagnetic Compatibility
4	ECE 432	Digital Communications
5	ECE 434	Multimedia Communication Networks
6	ECE 435	Wireless Communication Networks
7	ECE 449	Microdevices and Micromachining Technology
8	ECE 465	Digital Networks
9	ECE 520	Electromagnetic Field Theory
10	ECE 526	Electromagnetic Scattering
11	ECE 535	Advanced Wireless Communication Networks
12	CHE 494	Fundamentals and Design of Microelectronics Processing
13	CS 474	Object-Oriented Languages and Environments
14	Engr 400	Engineering Law
15	ME 501	Advanced Thermodynamics
16	Eng. Mgt.	Engineering Management

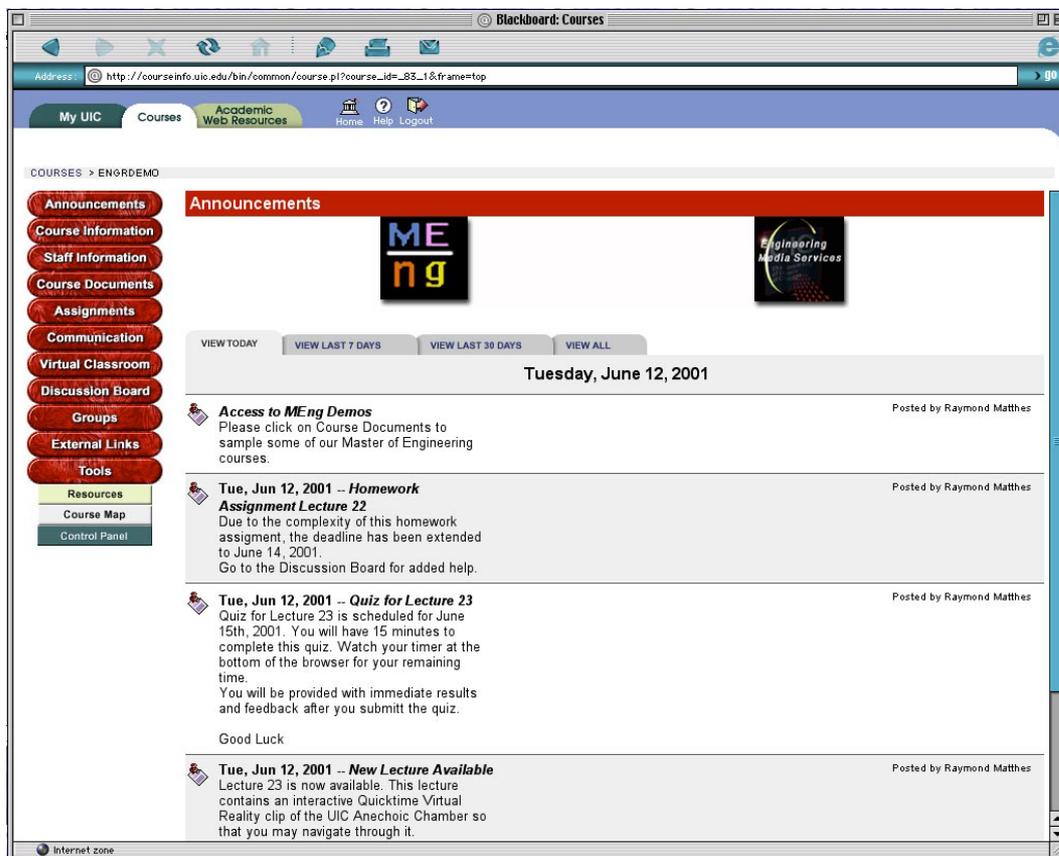


Fig. 1. Example of announcement page