Graduate Distance Learning in Nuclear and Radiation Engineering at the University of Texas at Austin

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Abstract

In 1998 the Nuclear and Radiation Engineering Program (NREP) at the University of Texas at Austin (UT) began offering a Masters of Science in Health Physics via distance learning. Originally the courses were taped and delivered by mail to the students, which proved to be time-consuming and cumbersome. This system has evolved to be totally Internet based with live transmission using a sophisticated piece of software called Prometheus. Courses offered now include Health Physics, Radioactive Waste Management, Radiation Shielding, Reactor Theory I and II, Radiation Biology, and Risk Assessment. Currently these courses are also being given for traditional graduate degrees in nuclear engineering. A discussion of the pitfalls and successes of this type of Internet approach will be discussed.

1. Introduction

In an ASEE PRISM article published in November 2000, the American Federation of Teachers outlined how there is presently a dramatic increase in distance learning students. In addition, this new way of receiving a degree is attracting many older students. With no or little on-site component, there is a possibility of offering a degree that is of lower quality Thus there is a need to set quality standards. There are many nuclear, radiological and radiation engineering programs that are faced with declining student enrollments at the undergraduate and even graduate levels. This is particularly true for US students at the post-graduate level. Several remedies have been implemented. These include amalgamating nuclear departments with other engineering departments, and offering introductory courses at the freshman level to attract students, undergraduate scholarships, cross-listing courses, and courses in non-traditional nuclear engineering such as health physics, radioactive waste management, medical physics, etc. One approach to attract new graduate students is to provide courses via distance learning. There have been several attempts to do this kind of graduate delivery with varying degrees of success. With the advent of the Internet and the availability of different forms of lecture presentations, distance learning degrees become much more attractive, although still not without pitfalls.

One of the UT College of Engineering's main goals is to recruit outstanding graduate students. In the nuclear field, as in other engineering disciplines quality students enter the workforce with high paying salaries and the vast majority of them do not consider the possibility of pursuing advanced degrees at the graduate level. Many potential high quality graduate students are at Department of Energy national laboratories, various industries, or other federal or state government facilities. Obtaining an advanced degree or degrees in new applied nuclear engineering areas would be of great benefit to them.

In 1997 the Nuclear Engineering program at the University of Texas at Austin, which is in the Department of Mechanical Engineering changed its name to the Nuclear and Radiation Engineering Program to better reflect the new areas of nuclear science and engineering. Since then our program has added two new faculty members and begun to restructure both its undergraduate and graduate programs. We began to offer an M.S. in Health Physics via distance learning and now have expanded the program to the Ph.D level for Health Physics and traditional nuclear engineering. Currently we have 23 graduate students of which 50% are US citizens and about 40% are distance learning. With only three full-time faculty, obtaining funding for 23 on-site students would be nearly impossible. Thus having self-employed students adds a very important dimension to our program since funding for them is not required.

2. Courses Offered

Presently the following courses listed below are offered. All these courses are at the graduate level with the exception of Radiation and Radioprotection Laboratory and Nuclear Reactor Engineering. The laboratory course is given over a two-week period during the summer on campus at the university. It includes eight laboratories and daily lectures. Faculty members at Texas State Technical College and the Civil Engineering Department at the University of Texas have given the courses in Radiation Biology and Risk Assessment, respectively.

- Nuclear Health Physics
- Radiation and Radioprotection Lab/Nuclear Analysis Techniques (2 weeks at UT)
- Radioactive Waste Management
- Reactor Theory I
- Reactor Theory II
- Nuclear Radiation Shielding
- Radiation Biology (Texas State Technical College)
- Decision Analysis/Risk Assessment (Civil Eng)
- Nuclear and Neutron Physics
- Nuclear Reactor Engineering
- Computational Methods in Radiation Transport

3. Course Delivery

Lectures are all prepared using Microsoft Power Point and delivered at the Faculty Innovation Center in the College of Engineering at UT. All lectures can be seen live on the Internet but more commonly are seen after work hours by distance learning students. The lecture room has seating for on-campus students who take the course. An electronic whiteboard is also available to write additional information or add to the existing slide. The software program Prometheus manages the complete course including posting of lectures, assignments, grades, special projects, homework solutions, previous exams, group e-mail addresses, and links to other sites related to the course. All lectures can be downloaded and printed with up to six slides per page to reduce the voluminous amount of information. Prometheus can also be used to facilitate in the dissemination of various course instructional information including PDF copies of journal papers, computer code executables, and code manuals.

4. Understanding Distance Learning

Often attracting graduate students who have been employed full-time for several years poses problems not usually encountered by newly graduated students applying to graduate school. Some GRE scores may be out of date and in some cases there is resentment of re-taking these exams. While these older students may be very motivated, work and family commitments may hinder progress and often extra time is needed by the student in order to complete assignments. Usually only one course per semester is taken by the student. This means that the length of graduate studies is longer than if the student is pursuing a degree full-time. Thesis projects are more difficult to manage and special care is required to nurture students who are almost never seen and where the only communication is by e-mail, telephone, or FAX

We also developed a very detailed website (www.me.utexas.edu/~nuclear) about our program that explains all aspects of it, including course offerings, current faculty interests and publications experimental facilities, pictures of current students, and links to all university requirements for admission and graduation. Such a website greatly helps distance learning students. While in general these students may require additional time and effort to advise and mentor, they have helped in getting the minimum number of students required for graduate classes. As well the students require no funding and thus new areas of research may be looked into without the need for time-consuming proposal writing. Having graduate students working full-time at national laboratories also opens up the possibility for seeking new sources of funding.

5. Conclusions

In general there has been a high degree of satisfaction from the distance learning students concerning course delivery and content. On-campus students have also expressed high satisfaction with the course delivery. In fact several on-campus students follow the courses exclusively through the Internet due to conflicts with jobs or time slots with other courses. While much effort is required to prepare the lectures, the final product is an excellent set of Power Point notes and electronic course material that can easily be updated and effectively used by students. The use of Prometheus is an excellent tool to manage the complete course. Lectures can be prepared in advance and placed on the website to allow faculty travel during the semester. The lectures can also be stored in an archive so that professors and students can review the material later on.

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Sheldon Landsberger is Professor and Coordinator of the Nuclear and Radiation Engineering Program. He received his B.S., Chemistry, Sir George Williams University, Canada in 1972, M.S., Nuclear Chemistry, Salford University, England in 1973, M.S., Nuclear Physics, Concordia University Canada in1976 and Ph.D., Chemical Engineering and Applied Chemistry, University of Toronto, Canada in 1982. His fields of specialization include radioactive waste management, health physics, neutron activation analysis, low-level counting, air pollution and long distance air transport of heavy metals, and solid waste management

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William Charlton is an Assistant Professor in the Nuclear and Radiation Engineering Program. He received his B.S., Nuclear Engineering, Texas A & M University in 1995, M.S., Nuclear Engineering, Texas A & M University in 1997 and Ph.D., Nuclear Engineering, Texas A & M University 1999. His fields of specialization include nuclear systems modeling with application to nonproliferation and nuclear safeguards, development and application of advanced nuclear analytical techniques (including neutron radiography and low-level detection technologies) and nuclear data measurement and analysis

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Marsha Creatchman
Marsha Creatchman is a Technical Writer in the Nuclear and Radiation Engineering Program and has prepared several of the courses in Nuclear Health Physics and Radioactive Waste Management for the distance learning website. She has also written all the laboratory experiments for the Radiation and Radiation Protection Laboratory. She received her B.A. in Early Childhood Education from Sir George Williams University in 1976 and M.A. in Special Education from the University of Toronto in 1984.