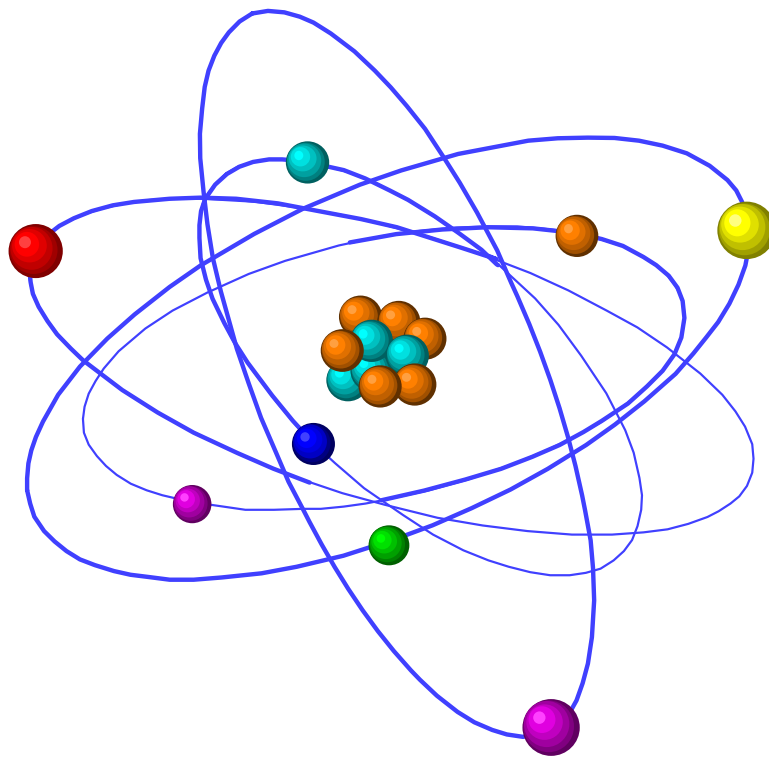


The University of Tennessee

DEPARTMENT OF NUCLEAR ENGINEERING



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**Undergraduate Studies
in
Nuclear and Radiological
Engineering**

2009-2010

SUMMARY

The Nuclear Engineering Department at The University of Tennessee offers exceptional opportunities to its students. Graduates contribute to important technologies needed by the United States to maintain its standard of living and its place in the world economy. This booklet provides information about UT's Nuclear and Radiological Engineering programs and career opportunities for graduates. Some of the main points are:

- Excellent academic program. The department benefits from its association with near-by Oak Ridge National Laboratory, and the concentration of nuclear research and industry in the area. The department's graduate program is ranked No. 12 in the nation by *U.S. News and World Report* (No. 11 among public institutions).
- Reasonable cost. Tuition and fees are among the lowest of the top academic institutions in America. Nuclear Engineering students from Alabama, Arkansas, Delaware, Kentucky, Louisiana, Mississippi, South Carolina, Virginia, and West Virginia can qualify for the same in-state tuition and fees paid by Tennessee residents. This major (~ \$12,000 per year) savings is made possible by an agreement among Southeastern states called the Academic Common Market.
- Scholarship opportunities. Nuclear Engineering students have excellent scholarship opportunities from UT, from national organizations which provide nuclear engineering scholarships and from the UT Nuclear Engineering Department. Over half of UTNE undergraduates have scholarships.
- Accelerated program to obtain Master of Science. The UT Nuclear Engineering Department has developed a Master Student Program in which top undergraduates begin their graduate course work and graduate research while still an undergraduate. This reduces the time required to obtain a M.S. degree after the B.S. by as much as one half.
- Internship and Co-op Programs. The department participates in the UT College of Engineering Co-op and Internship Program. See www.coop.utk.edu.

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THE UNIVERSITY OF TENNESSEE

The University of Tennessee is Tennessee's "campus of excellence" in undergraduate, graduate, and professional studies; research and creative activity; and public service. The University offers more than 300 degree programs to its 26,000 students. High academic standards and very reasonable tuition and fees make UT one of the best bargains in higher education in America.

UT's location is very favorable for a rewarding undergraduate experience, especially in science and engineering. Knoxville is a pleasant, mid-sized city with all of the usual cultural and social amenities but few of the inconveniences of life in a large city. Nearby are beautiful mountains and lakes that provide opportunities for diversion from the rigors of student life. The Knoxville-Oak Ridge community provides a unique environment for enhancing the University's programs in science and engineering. The concentration of advanced scientific and engineering activity and the professionals involved in this work create an intellectual climate that is beneficial to UT and to its students

THE NUCLEAR ENGINEERING DEPARTMENT

Established in 1957, the UT Nuclear Engineering Department is one of the oldest and most prestigious programs in the United States. The department is housed in the Pasqua Engineering Building, devoted exclusively to nuclear engineering. The building contains classrooms, offices, laboratories, shops, computer facilities, and a lounge for students and faculty. This facility helps to maintain the cohesiveness among students and the faculty, which characterizes the program.

The department provides a comprehensive program to prepare young men and women for rewarding careers.

- Students learn from and interact with a world class faculty.
- The nuclear engineering curriculum constantly remains at the forefront of the technology.
- Students use facilities at nearby Oak Ridge National Laboratory to supplement on-campus facilities for laboratory experience.

- Excellent scholarship programs are available for outstanding students.
- Students have the opportunity to hear international leaders in nuclear engineering speak in the area at frequent lectures and seminars that occur in the Knoxville area because of the high concentration of nuclear research and industry in the area.
- An excellent Co-op program is available to provide students work experience in engineering companies and laboratories throughout the United States.
- Nuclear engineering students identify with a small, elite group within the University. Nuclear engineering students receive very personal attention with easy access to the faculty.
- Nuclear Engineering students receive excellent preparation for graduate study to obtain Master's or Doctoral degrees.

The strength of the department and its program has been recognized in many ways.

- UT nuclear engineering students have won either 1st or 2nd place in the American Nuclear Society's National Design Competition at the undergraduate or graduate level every year except two since the competition began in 1975.
- UT faculty and graduate students publish over 30 papers per year in the technical literature.
- The UT nuclear engineering B.S. program is fully accredited. The most recent evaluation resulted in high praise for the program and the strongest level of accreditation was awarded.
- Graduates have had great success in their careers. Starting salaries are near the top in the engineering profession and many UTNE graduates have quickly moved to high-level positions. Projections indicate future shortages of nuclear engineers.
- The UT Nuclear Engineering Department has a major research program with over twenty projects and over \$2,000,000 in outside funding. This helps to maintain relevance and excitement in the undergraduate teaching program.
- The UT Nuclear Engineering Department is the third largest nuclear engineering program in the U.S. based on total student enrollment.

CAREERS IN NUCLEAR ENGINEERING

Nuclear Engineering is the branch of engineering that focuses on the application of sub-atomic processes to develop new ways to enhance human life and protect our environment. The Department of Nuclear Engineering at UT offers two major areas of concentration, traditional nuclear engineering and radiological engineering.

Traditional nuclear engineering provides most of the career opportunities for nuclear engineering graduates. Nuclear fission power plants currently provide about twenty percent of the electricity for the United States. The percentage is even higher in several other countries (France, Belgium, Japan, and Taiwan). Nuclear power is recognized as essential for countries competing in the modern world. Lessons learned from the first stage of nuclear plant construction and operation is now driving the development of new ultra-safe, economical power plant designs. Nuclear engineering graduates contribute to this progress through careers with electric utilities, plant manufacturers, architect-engineering firms, national laboratories, and engineering service companies.

Fusion power is also being pursued in order to tap the unlimited potential of thermonuclear energy for producing electricity. This is a very difficult problem which will take many years to solve, but success will provide tremendous benefits to society. Graduate nuclear engineers contribute to this effort in research teams at national laboratories and universities.

Ionizing radiation is and always has been a natural part of our environment. However, modern technology results in high concentrations of radioactivity in certain locations. The public must be protected by containment, isolation, and shielding. The branch of nuclear engineering that deals with this problem is called radiological engineering or health physics. Nuclear engineering graduates serve this need in all branches of science, industry, and medicine where radioactive materials are involved.

Like most activities that enhance the quality of life, nuclear-related activities result in waste. Since nuclear waste can be hazardous for a long time, special care is required in its handling and storage. The absolute volume of nuclear waste is small, but the effort needed to deal with it properly is large. Many nuclear engineering graduates concentrate on handling, packaging, transporting, and disposal of nuclear wastes.

Radiation-related techniques have been used in medicine for a long time. We are all familiar with the benefits and dangers of X-rays. New radiation-related medical systems are among the fastest growing components of the health care industry. Health care is also benefiting from a whole new class of machines that involve radiation and its measurement. Examples are PET (positron emission tomography) and MRI (magnetic resonance imaging). Nuclear engineers find many new and challenging opportunities in this rapidly expanding field.

THE NUCLEAR ENGINEERING CURRICULUM

The nuclear engineering curriculum consists of a systematic, fully accredited program to prepare graduates for productive careers. The first two years are devoted to general science and engineering courses needed as preparation for the specialized courses taken in the last two years. In the last two years, Nuclear Engineering students select one of two available tracks, traditional Nuclear Engineering or Radiological Engineering. The courses of study are described in detail in the UT Undergraduate Catalog, which is online at <http://catalog.utk.edu/index.php>.

COURSE DESCRIPTIONS

The course descriptions for all of the courses in the nuclear engineering B.S. curriculum are also described in the UT Undergraduate Catalog at <http://catalog.utk.edu/index.php>.

Non-Technical Electives

Students take at least eighteen semester hours of humanities and social science electives. These electives serve a three-fold need: to provide an expanded sensitivity to the human aspects of the practice of engineering; to enrich the student's knowledge of the world in which he or she lives-its culture, behavioral patterns, history, and governance; and to provide a basis for the appreciation of and the ability to deal with complex interactions between technology and society in the contemporary world. Engineers are now working with new constraints that demand a consciousness of the social and political implications of their work. They are interacting with the public in explaining their work as the public demands greater participation in the decision-making process concerning the utilization of technology. Because of the significance of this technology-

society interaction, engineering students are encouraged to consider carefully their selection of required electives in this area.

ADMISSIONS

Freshman Admissions

For admission purposes, a student is classified as an entering freshman if:

1. the student has graduated from high school; and
2. the total of attempted college-level credit work at an accredited institution after graduation from high school has been less than 12 hours, excluding summer school and college courses taken while still in high school.

Students are encouraged to apply as early as possible. Early admission contributes to better orientation, course planning, class scheduling, and financial aid consideration. High school students planning to apply should submit applications as soon as possible after completion of the junior year. Applications for admission are available from many secondary school guidance/counseling offices and from the Office of Admissions, UT, 320 Student Services, Knoxville, TN 37996-0230 or may be downloaded from the web at www.utk.edu. The University seeks to admit those who can provide evidence of the intellectual performance and potential that will permit them to benefit from UT programs.

A prospective student must have completed at least

four (4) units of English;

three (3) units of math including two (2) units of algebra and one (1) unit of advanced math, trigonometry, geometry or calculus (The College of Engineering requires 3-1/2 years of math including trigonometry and geometry as prerequisites for all courses);

two (2) units of natural sciences including at least one (1) unit of biology, chemistry, or physics;

one (1) unit of American History;

one (1) unit of European or world history or world geography;

two (2) units of a single foreign language; and

one (1) unit of visual or performing art.

Applicants with foreign language deficiencies from those high schools that do not offer the required two years of a single foreign language may, with proper approvals, be

admitted to the university. However, this deficiency must be removed during the first two years (60 semester hours) of university work.

In addition to the application form, a freshman must

1. Have a final transcript of all high school credits sent to the Admissions Office. If any courses have been taken for college credit, the institution(s) granting credit must send an official transcript to the UT Admissions Office as a part of the admission file. Students who have achieved a high school diploma through the General Education Development (GED) Test also must have the GED scores sent. Older than average students may be given special consideration.
2. Send the score report of the American College Testing program (ACT) or the Scholastic Aptitude Test (SAT) to the Admissions Office. The score report is a necessary part of the application.
3. Pay a nonrefundable application fee.
4. Submit any additional items or information requested in the application materials or by the Office of Admissions.

Any applicant who is denied admission may make a written appeal to the Director of Admissions.

Advanced Placement Examinations

Freshman admitted to UT may receive credit on the basis of performance on one or more of the Advanced Placement Examinations offered each May by the College Entrance Examination Board (CEEB) in several subject areas. High school students preparing to enter college usually take the tests during the junior year.

Departments at UT that grant advanced placement credit for satisfactory test scores include Art, Biology, Chemistry, English, History, French, Spanish, German, Latin, Mathematics, Music, and Physics. The CEEB sends scores and test books on request to the Director of Admissions at UT in June or July. Each participating department decides the acceptable score for credit. Information can be obtained from the Admissions Office or from the Liberal Arts Advising Center.

Transfer Applicants

A student who has attempted 12 hours or more of college credit course work at one or more accredited programs of higher education and who does not qualify as a

freshman applicant under the rules described above must apply for admission as a transfer student. In addition to high school transcripts, a complete transcript of all work at each college or university attended should be submitted by the institution directly to the UT Admissions Office. Transcripts carried by the student may be useful in the advising and course selection process, but they are not acceptable in the admissions file. Transfer students who have taken neither the ACT nor the SAT are not required to do so. Upon admission to UT, a transfer student may be classified as a freshman, sophomore, junior, or senior, according to the number of hours passed. Only those courses in which a grade of C or better was earned shall be eligible for transfer credit.

The faculty, through the deans and directors of colleges and schools at UT, has the responsibility for determining which courses from other institutions will be accepted for transfer credit. Certain transferable courses are not equivalent to special UT courses. These courses may be used to meet specific curriculum requirements with the approval of the UT college or school in which the student's program is located. Appeals concerning transfer of course credit, whether by institutions or by individuals, should be addressed to the dean of the appropriate UT college or school for review.

Prospective transfers to UT are encouraged to complete a sequence of related courses rather than transferring a single course from a series. Students at two-year community colleges, particularly within the State of Tennessee, are encouraged to complete the associate degree requirements prior to transferring to UT, provided that such action is consistent with their educational goals.

In order to be considered for admission to UT, a transfer applicant must have transfer grade point average of 2.00 or better (on a 4-point scale) for all courses eligible for transfer credit. The Nuclear Engineering Department encourages enrollment of well-qualified transfer students. Articulation Agreements have been developed with pre-engineering programs in other universities and colleges in Tennessee. Special effort will be made to accommodate students from other schools so that they will suffer minimum loss of time in transferring.

COST

The cost to attend the University of Tennessee is very reasonable compared to other public, state-supported universities. Detailed cost information is available online at

<http://web.utk.edu/~bursar>. In addition, the Academic Common Market, an agreement among several states, may provide a discount. Participating states are able to make arrangements for their residents who are to be fully admitted to specific programs at UT on an in-state fee basis, when these programs are not available in their state of residence. Under this program students from Alabama, Arkansas, Delaware, Kentucky, Louisiana, Mississippi, South Carolina, Virginia, and West Virginia may enroll in the Nuclear Engineering program at UT and not have to pay out-of-state fees.

The Academic Common Market Coordinators for member states in which residents may obtain in-state status to enroll in the UT Nuclear Engineering Program are listed below.

Alabama

Dr. Paul Mohr
Academic Common Market Coordinator
Alabama Commission on Higher Education
P.O. Box 30200
Montgomery, Alabama 36130-2000
Phone: (334) 242-1998

Arkansas

Cynthia J. Moten
Academic Common Market Coordinator
Department of Higher Education
114 East Capitol Avenue
Little Rock, Arkansas 72201
Phone: (501) 371-2016; fax (501) 371 2003
cynthiam@adje.arknet.edu

Delaware

Cynthia Kirkpatrick
State Coordinator
Delaware Higher Education Commission
Carvel State Office Building
820 N. French Street
Wilmington, DE 19801
Phone: (302) 577-5245
Fax: (302) 577-6765

Kentucky

Dottie C. Stone
Academic Programs
Council on Higher Education

1024 Capital Center Drive, Suite 320
Frankfort, Kentucky 40601
Phone: (502) 573-1555

Louisiana

Carolyn Blanchard
Academic Common Market Coordinator
Louisiana Board of Regents
150 Third Street, Suite 129
Baton Rouge, Louisiana 70801-1389
Phone: (504) 342-4253

Mississippi

Pearl Pennington
Director for Academic Student Affairs and Off-Campus
Programs
Board of Trustees of State Institutions of Higher Learning
3825 Ridgewood Road
Jackson, Mississippi 39211
Phone: (601) 982-6486

South Carolina

Pamela Spires
Administrative Coordinator
Commission on High Education
1333 Main Street, Suite 200
Columbia, SC 29201
Phone: (803) 737-2260

Virginia

Aris Bearse
State Council for Higher Education
101 North 14th Street, 9th Floor
Richmond, Virginia 23219
Phone: (804) 225-2628

West Virginia

Mark Stotler
Academic Common Market Coordinator
West Virginia Board of Regents
Student Educational Services
1018 Kanawha Boulevard, East, Suite 700
Charleston, West Virginia 25301
Phone: (304) 558-0263

Interested students from these states are encouraged to contact their coordinator and take advantage of this opportunity, which can amount to a tuition savings of approximately \$12,000 per year.

FINANCIAL ASSISTANCE

Good students have many opportunities to obtain financial assistance through scholarships and summer professional employment. UT has a number of general scholarships available that should be pursued by qualified students. These are listed in the Undergraduate Catalog. Early admission application is essential to the scholarship selection process. Hope Scholarships are also available to most Tennessee residents. Students are encouraged to complete the admission process during the fall semester of their senior year. All students who have been accepted for admission to UT by the February 1st deadline are automatically considered for all General University scholarships. No other application is needed to apply for these scholarships. Students are ranked by the General Scholarship Committee according to their high school GPA and standardized test scores. Most General University scholarships are based on academic merit only; however, some scholarships are based on academic merit and financial need and/or leadership and community service activities. Students should be sure to complete the Scholarship Data Sheet included with the admission application. Although the Scholarship Data Sheet is not required for consideration, this will help the scholarship committee to better evaluate students. Honors and awards received by students should be listed as well as community service activities and any employment positions. Also, students should list activities and employment experiences whenever possible, and especially on standardized test forms.

In addition, special opportunities exist for Nuclear Engineering students:

- Pasqua Nuclear Engineering Scholarships are \$2000 scholarships offered to incoming freshman and transfer students. The Department provides ten to fifteen of these per year.
- American Nuclear Society Scholarships. The American Nuclear Society offers scholarships with grants of \$1,000 to \$3,000. The Department will assist qualified students in applying for these scholarships.

- National Academy for Nuclear Training. The Academy offers a \$2,500 scholarship to outstanding Nuclear Engineering students. The Department will assist students in applying for these scholarships.
- Nuclear Regulatory Commission Scholarships, which can provide scholarship amounts up to \$10,000.
- Co-op and Internship Program. The Nuclear Engineering Department participates in the UT Engineering Co-op and Internship Program. Students work in nuclear engineering positions in industry and at national laboratories. Students gain valuable experience and income through participation in the co-op and internship program.
- DOE Summer Programs. The Department of Energy has numerous summer employment positions for Nuclear Engineering students at national laboratories across the country. The Department maintains a file of information about these opportunities and helps students obtain appointments.

There are also extraordinary opportunities for minority students at UT Knoxville through a special program. Established in 1973, the Minority Engineering Scholarship Program, which is now called the Diversity Engineering Scholarship Program, encourages minority students to take advantage of the growing opportunities in engineering. The program combines academic work at UT with periods of paid, on-the-job engineering training with companies. Students in the program can receive as much as \$36,000 in scholarship money and co-op earnings. This combination of work experience and academic course work results in better career preparation than academic courses alone can provide. UT ranks thirteenth in the nation in the number of degrees awarded to minority engineering students.

Overall, Nuclear Engineering students at UT have an unparalleled opportunity to finance a large portion of their educational costs. Over half of UT undergraduate Nuclear Engineering students have one or more scholarships each year.

MASTER STUDENT PROGRAM

The Nuclear Engineering Department now offers a special program that will enable outstanding students to obtain a Master of Science Degree in approximately one

year (or less) after receiving the B.S. degree in NE. Normally, students spend one and one-half to two years working on the M.S. degree. This time is required in part to complete the required courses; but, more significantly, to complete the research requirement associated with the M.S. degree.

The Master student program permits accelerated progress towards a M.S. degree by allowing the student to begin satisfying M.S. course and research requirements while still an undergraduate. Students earn six to twelve credit hours of graduate credit in their senior year. These courses will satisfy one fourth to one half of the M.S. coursework requirements. This is made possible when the normal senior year requirements are completed early due to advanced placement high school credits or by attending summer school, attending mini-terms, or taking UT Distance Education courses.

Students in the Master student program usually begin work on their research in the summer after their junior year. They are hired by the department to work on a project, which will eventually be the student's thesis research project. During the senior year, students continue working on the project (typically ten hours per week). Consequently, when the student completes his/her B.S., a significant amount of work associated with the initial phase of a research project will have been completed. Incidentally, the students will earn money to help finance their undergraduate education. The Master student program is restricted to students with outstanding academic performance. Students in the program usually have a grade point average of at least 3.5.

A COMMITMENT

The University, especially the Nuclear Engineering Department, pledges to offer its students a challenging and rewarding academic experience. We offer students every opportunity to achieve at the limit of their capability.

NOTICE

This booklet was prepared by the Nuclear Engineering Department as a source of information for prospective students. Information was collected from University of Tennessee publications and every effort was made to report accurate and current information. Students may obtain official information by consulting the Undergraduate

catalog or by contacting the Admissions Office. Recent update information is also available via the Internet at www.utk.edu and at www.engr.utk.edu/nuclear.

The University of Tennessee does not discriminate on the basis of race, sex, color, religion, national origin, age, handicap, or veteran status in provision of educational opportunities or employment opportunities and benefits. UT does not discriminate on the basis of sex or handicap in its educational programs and activities, pursuant to requirements of Title IX of the Educational Amendments of 1972, Public Law 92-318, and Section 504 of the Rehabilitation Act of 1973, Public Law 93-112, and the Americans with Disabilities Act of 1990, Public Law 101-336, respectively. This policy extends to both employment by and admission to the University. Inquiries concerning Title IX, Section 504, and the Americans With Disabilities Act of 1990 should be directed to the Office of Affirmative Action, 403-C Andy Holt Tower, The University of Tennessee, Knoxville, Tennessee 37996-0144; or telephone (865) 974-2498. Charges of violation of the policy should also be directed to the Office of Affirmative Action.