College of Engineering

Way Kuo, Dean and University Distinguished Professor
Wayne T. Davis, Associate Dean for Research and Technology
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Luther R. Wilhelm, Associate Dean for Special Projects

http://www.engr.utk.edu/coe/undergraduate/new_index.html

Engineers solve problems. To do so, they apply science, mathematics, and creativity to invent, design, test, build and operate engineering systems that will meet the needs of society. In the latter half of the 20th century, engineers developed the personal computer, the space shuttle, artificial hearts and many other "high-tech" products. The opportunities to use technology for the benefit of 21st century society will be even greater.

Engineers use the same problem-solving strategies whether designing a bridge, trouble shooting a computer chip problem or developing a more efficient automobile engine. This commonality of approach makes it easy for an engineer to move from one specialization to another, and it happens frequently. The engineer's can-do, problem solving outlook is also good preparation for management, and many engineers follow this career path.

Increasingly, engineers must also have good interpersonal skills to work effectively in the interdisciplinary groups required to tackle modern engineering projects. They must understand the ethical, environmental, social, political, and business implications of their work. Engineers must work comfortably among the cultures, customs and languages of multi-national enterprises.

In light of modern society's ever-increasing dependence on technology, there is a continuing and urgent need for engineering graduates who possess the high levels of technical competence and social understanding that will enable them to fulfill their responsibilities as professional engineers. The College of Engineering prepares men and women to face these challenges and to seize their opportunities to become the technology leaders of the 21st century.

Graduates of the Bachelor of Science curricula offered by the college may enter directly into a position in industry, government, or private practice, or may pursue advanced study in graduate school. Their professional activities include research, development, design, operations analysis, construction, production supervision, and technical sales. Many practice their profession in Tennessee; but engineering knows no geographical bounds, and graduates of the college serve throughout the nation and in other countries as well.

The college offers eleven undergraduate majors – aerospace engineering, biomedical engineering, chemical engineering, civil engineering, computer engineering, electrical engineering, engineering physics, industrial engineering, materials science and engineering, mechanical engineering, and nuclear engineering.

Biosystems engineering is based in the College of Agricultural Sciences and Natural Resources with facilities located on the Agricultural Campus. The biosystems engineering curriculum is offered cooperatively by the College of Agricultural Sciences and Natural Resources and the College of Engineering. Details of the curriculum may be found in the College of Agricultural Sciences and Natural Resources section of this catalog.

The college, in cooperation with industrial sponsors, established the Minority Engineering Scholarship Program in 1973 and in 1999 renamed it the Diversity Engineering Scholarship Program. The program's goal is to increase significantly the number of qualified minority engineering graduates.

College Admission Requirements

To promote the maximum opportunity for success among entering freshmen, the College of Engineering has established college admission requirements in addition to the general university admission requirements. These additional admissions criteria are based upon both high school and standardized test performance, with an emphasis upon assessment of mathematics skills.

For admission to the College of Engineering, entering freshman students must meet the requirements for admission to the University of Tennessee, and they must also have a Success Prediction Indicator (SPI) of at least 57.0. The SPI is calculated by adding an individual's ACT mathematics score to 10 times their high school core GPA (based on a 4.0 scale). Thus, a student with a core GPA of 3.5 and a mathematics ACT score of 28 would have an SPI of 63 = (28 + 10x3.5). SAT scores are converted to an equivalent ACT score to perform this calculation.

Students who wish to pursue an engineering degree at the University of Tennessee, Knoxville, but do not meet the SPI criterion may enroll as University Undecided students and complete appropriate mathematics, science, and other courses before applying for admission to the College of Engineering. (See the statement regarding Transfer Students later in this section.) The college welcomes qualified transfer students from community and other colleges.

Facilities

Most of the college's facilities are on the southeastern corner of The Hill. Administration and Civil and Environmental Engineering are in Perkins Hall; Electrical and Computer Engineering are in Ferris Hall; Industrial and Information Engineering and the Interdisciplinary Engineering Research Centers are in East Stadium Hall; Nuclear Engineering is in the Pasqua Engineering Building; Mechanical, Biomedical, Aerospace, Chemical, and Materials Science are in Dougherty Hall. The Engineering Fundamentals Division and Engineering Diversity Programs office are located in Estabrook Hall. The Co-op office is in Perkins Hall. The Engineering Physics program is administered through the Physics Department in the Nielsen Physics Building.

Office of Professional Practice

The Office of Professional Practice which administers cooperative engineering program (Co-op) provides an augmented engineering education that includes significant experience in industry as well as superior academic preparation. Our cooperative engineering program was established in 1926. The University of Tennessee was one of the early pioneers in this valuable type of education.

Co-op work assignments differ from part-time or summer employment in that they involve regularly scheduled cycles of full-time academic terms alternating with full-time work periods, resulting in planned, career-related work terms of progressive complexity and responsibility. In introducing the student to engineering employment, the college and industry join together to offer a broader and richer preparation for postgraduate employment than can be provided by a conventional academic program. This experience in an industrial and professional environment contributes to the student's maturity, accelerates professionalism, offers an opportunity to apply engineering coursework in a real-world setting, and enables the student to define more clearly educational and career interests and objectives. All positions are paid positions, and most students are able to offset a substantial amount of their college expenses with Co-op savings.

Introduction to the cooperative engineering program (for new students, transfers, second-degree students, and re-entry students) begins in the first semester at the university. Assignments are determined by employer and student. All engineering students are encouraged to visit the program office.

Candidates must be able to project a minimum of 52 weeks of Co-op experience prior to the senior year, within the regular alternating sequence, to qualify for an assignment.

Further details may be obtained from the Office of Professional Practice, 310 Perkins Hall, The University of Tennessee, Knoxville, TN 37996-2030. You may also contact the Co-op office via e-mail at coop @ engr.utk.edu or via the program home-page at http://www.coop.utk.edu

International Engineering Program

The United States, like most countries throughout the world, can no longer thrive economically with only a domestic market for its goods and services. To compete in the global marketplace, engineers must understand how to design and manufacture products for world-wide use. The College of Engineering works with several organizations, both on and off campus, to enable interested students to participate in significant engineering experiences abroad. Students interested in making an international experience part of their engineering education should begin exploring opportunities and develop plans during the freshman year. Language preparation to a level of substantial proficiency may be required. Thus, language preparation should be started immediately. For further information on international engineering educational programs, contact the Center for International Education, 1620 Melrose Avenue.

Graduate Program

Graduate programs leading to the Master of Science are offered in twelve majors – aerospace engineering, biomedical engineering, chemical engineering, civil engineering, electrical engineering, engineering science, environmental engineering, industrial engineering, materials science and engineering, mechanical engineering, nuclear engineering, and polymer engineering. The Doctor of Philosophy is offered in eleven majors – aerospace engineering, biomedical engineering, chemical engineering, civil engineering, electrical engineering, engineering science, industrial engineering, materials science and engineering, mechanical engineering, nuclear engineering, and polymer engineering. Information concerning graduate programs is given in the *Graduate Catalog*.

Tau Beta Pi National Headquarters

The college is honored to have the national headquarters of Tau Beta Pi, the Engineering Honor Society, housed on our campus since 1907. This honor was earned in part through the untiring efforts of R.C. "Red" Matthews, Secretary-Treasurer for the organization from 1905 to 1947. The suite of offices, located in Dougherty Hall, is occupied by Mr. J.D. Froula, Secretary-Treasurer, R.E. Hawks, Assistant Secretary-Treasurer, and eight additional staff members.

National Accreditation

Since 1936, engineering programs at institutions of higher learning have been accredited by an organization formed by many engineering societies and known as the Accreditation Board for Engineering and Technology (ABET). ABET accreditation ensures that graduates of the University of Tennessee, Knoxville, engineering programs are adequately prepared to enter and continue the practice of engineering. Accredited engineering programs at the University of Tennessee, Knoxville, include aerospace, biomedical, biosystems, chemical, civil, computer, electrical, industrial, mechanical, materials science, and nuclear.

Accreditation criteria require each engineering degree program to design a curriculum and educational process that will achieve defined educational objectives consistent with ABET criteria and the mission of the University of Tennessee, Knoxville. The educational objectives of each degree program are presented by the department responsible for the program later in this chapter. In each case the objectives are consistent with the mission of the College of Engineering. That mission is to

- Provide high quality education in the major engineering disciplines from the undergraduate through doctoral levels through a creative balance of academic, professional, and extracurricular programs.
- Foster and maintain mutually beneficial partnerships with our alumni, friends, industry, and local, state, and federal governments through public services, assistance, and collaborative research.
- Be a major contributor to our nation's technology base through scholarship and research.

In addition, the educational objectives of each degree program are also guided by and consistent with the strategic objectives of the College of Engineering. Two particularly relevant strategic objectives are "to continuously provide quality delivery of courses, programs, extracurricular activities, assistance, and support that enhances each student's desire to learn and that excites each student's interest in engineering and the work environment" and "to continuously provide and improve the education and working abilities that employers want our engineering graduates to have."

ABET accreditation criteria also require an assessment process to ensure that program outcomes critical to successful engineering practice are being achieved. Assessment of eleven program outcomes common to all engineering disciplines are required by ABET. Specifically, each engineering degree program must demonstrate that its graduates have

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global/societal context.
- A recognition of the need for and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The College of Engineering has embraced these program outcomes as valid and valuable indicators of educational program effectiveness. Thus, the college prepares students to demonstrate sufficiency and to strive for excellence in each of these areas. This goal is achieved by ensuring that instruction and other learning experiences are provided that will produce each program outcome. Engineering courses, mathematics and natural science courses, and the humanities and social sciences each provide essential contributions to the achievement of this goal. Program outcomes that are critically dependent on humanities and social science courses are discussed in the General Education Requirement section to follow. Additional program outcomes selected by individual degree programs to supplement ABET outcomes are also discussed in subsequent sections.

Designation of a Minor

An engineering undergraduate may declare a minor in a non-engineering subject area and have the minor listed on the permanent record under the following conditions.

- Minors must be officially approved and described in the *Undergraduate Catalog*. No unofficial minors will be recognized.
- Courses taken to satisfy the minor may also be used to satisfy engineering degree requirements provided that the courses would be a part of engineering degree requirements even if no minor was declared. Completion of a minor often involves the taking of some courses which cannot be used to satisfy the minimum requirement for an engineering degree.
- A student should notify his or her advisor and major department office when beginning work on a minor. The intention to complete a minor must be declared at the time of application for graduation if the minor is to appear on the final transcript. Graduation applications are available in the Office of the University Registrar.

Minor in Reliability and Maintainability Engineering

A coursework program leading to a minor in reliability and maintainability engineering is offered by the College of Engineering. Fifteen hours of coursework are required as listed below. The grade in each of the required classes must be at least a C. Students should consult with their advisor for the appropriate elective courses in their major.

	Hours Credit
Core courses	6
Industrial Engineering 483 or Mechanical Engineering 483 or Nuclear Engineering 483	
Industrial Engineering 484 or Mechanical Engineering 484 or Materials Science and Engineering 484 or Nuclear Engineering 484	
Statistics or Math Requirement (choose 1)	3
Chemical Engineering 301	
Electrical and Computer Engineering 313	
Mathematics 323	
Statistics 251	
Electives (choose at least 2)	6
Chemical Engineering 360	
Electrical and Computer Engineering 315, 471	
Industrial Engineering 300, 440	
Statistics 365 (for non-Industrial Engineering)	
Mechanical Engineering 345, 363	
Nuclear Engineering 304	
	Total 15

Course Load

The maximum number of hours which can be taken by an undergraduate engineering student without special permission is 19. The Associate Dean for Student Affairs must give permission to take 20 hours or more. In general, this decision is based on the student's previous performance at the University of Tennessee, Knoxville.

General Requirements

Students are advised to consult the university's degree requirements as stated in the front section of this catalog, as well as departmental requirements.

Transfer Students

Transfer students, including internal University of Tennessee, Knoxville, transfers, must meet the minimum requirements stated below to be considered for admission to a major within the college.

- Must have earned a minimum 2.30 cumulative average and a C or better in each of these specific courses, or their equivalent: English 101, Chemistry 120, and Mathematics 141 (and subsequent courses in the three sequences, if taken).
- The overall record will be evaluated for quality and seriousness of purpose. An excessive number of withdrawals, incompletes, repeated courses, or failures may result in denial.

Any University of Tennessee, Knoxville, student desiring association with one of the departments of the College of Engineering should go to the departmental office for the desired major. An interview with the department head or his/her designee is held, with the major items of consideration being the same as for external transfer students. If association is granted, a College/Major/Advisor Change form is processed by the department to officially change the student's academic home.

Transfer Credit

Every attempt will be made to give maximum credit for courses taken elsewhere and transferred to the college. Discussions concerning the evaluation of transfer credits should be conducted with the head of the department (or designee) into which the student is to transfer, but only after receiving the evaluation of transfer credits by the Admissions Office.

Second Bachelor of Science Degree

Upon approval by the Dean of Engineering and the Committee on Degrees of a program of study recommended by the major engineering department, a student who already holds a bachelor's degree may obtain a degree in engineering upon meeting all of the course requirements of the selected engineering program. In no case will the minimum requirement be less than 30 semester credits. The prevailing university regulations shall apply.

Satisfactory/No Credit Courses

Engineering majors may take half of the minimum hours required (nine) of general education electives on a Satisfactory/No Credit (S/NC) grading basis. No other courses specified as part of the minimum degree requirements may utilize Satisfactory/No Credit grading, unless a course is offered only on that grading basis. Students are encouraged to take courses of interest which are not part of the minimum degree requirements, and to fully utilize the Satisfactory/No Credit grading option for such coursework.

Correspondence Courses

A student should check with his or her major department to see what restrictions there are, if any, on the use of correspondence course credit to meet the minimum degree requirements.

University General Education Requirement

The University of Tennessee has established a University General Education Requirement that includes emphases upon building basic skills and developing broadened perspectives. These requirements apply to all undergraduate students and are listed at the front of this catalog. Engineering students should consult with their advisor and carefully select General Education Electives to insure that courses meet the general education needs of their program and courses meet the University General Education Requirement.

American History Requirement

Engineering students, regardless of national origin, must fulfill the American history requirement described elsewhere in this catalog. Those students who have not had the required year of American history in high school may choose the required 6 hours from History 221 and 222, or other courses deemed suitable by the Department of History. See additional information about the American History Requirement in the Academic Policies and Procedures section of this catalog.

Technical Electives

Technical electives are to be selected with the advice and approval of the student's major department. In some of the curricula tabulations a choice of such electives is indicated, and regulations in regard to their selection are stated.

The Voluntary ROTC Program

Engineering students may participate in the ROTC Program. Advanced ROTC courses (300- and 400-series) may be counted as technical elective credit toward an engineering degree up to a total of 6 hours. Normally, military science and leadership courses cannot be used as humanities/social science electives. Individual departments determine the appropriate substitutions.

Approval of Electives and Substitutions

Each student shall discuss with an advisor the status of the program of study no later than the beginning of the second semester prior to anticipated graduation. Any necessary additions to or substitutions in the program or electives requiring special approval must be approved in writing at that time. It is each student's responsibility to see that all necessary approvals are secured. Inattention to such matters will most likely delay graduation.

Curricula

Course requirements for the various engineering curricula are listed in each department's section. Individual course prerequisites should be strictly adhered to, even if courses are not taken in the semester indicated. Although the requirements for each major can be completed in four academic years (five for the cooperative program), the quality of the learning experience is much more important than the speed with which the curricula are completed.

Questions about individual courses should be directed to the department responsible for the course. Questions about a particular curriculum should be directed to the major department.

Prerequisites

Before registering for any engineering course, a student should make certain that any necessary background work has been completed. In addition to specific prerequisites listed, it is assumed that a student taking sophomore engineering courses has completed all freshman courses, whether specifically listed as a prerequisite or not. When this is not the case, a student should seek advice from the advisor or department responsible for the course in question before registration in order to minimize the chances of academic difficulty. Students who do not have prescribed prerequisites may be dropped from a course at any time during a semester when the lack of prerequisites is discovered.

ENGINEERING FUNDAMENTALS DIVISION

J. R. Parsons, Director

Professors

Bennett, R.M., Civil and Environmental Engineering
Parsons, J.R., Mechanical, Aerospace and Biomedical Engineering

Associate Professors

Pionke, C.D., Mechanical, Aerospace and Biomedical Engineering
Scott, T.H., Nuclear Engineering

Instructor

Schleter, W.R., Engineering Fundamentals

The Engineering Fundamentals Division is the academic home for all first-year engineering students. Located in Estabrook Hall, the division serves as a focus for all freshman student activities. The faculty of the division act as academic advisors and teach the principal courses in Engineering Fundamentals. These courses are designed to prepare students for entry into the sophomore year of every major in the college. Academic standards in the first year are necessarily high. To assist students with deficient academic backgrounds in the necessary mathematics and computer skills, supplementary courses are offered as needed.

New freshman students are assigned to the Engineering Fundamentals Division for academic advising and career counseling until they have completed the freshman curriculum. Freshman students admitted to the College of Engineering are required to designate a field of study by the end of their freshman year. As sophomores, students are assigned faculty advisors in their selected departments.

Minor in Engineering Communication and Performance

The division co-administers, with the College of Education, Health, and Human Sciences, the engineering communication and performance minor for engineering students desiring additional training and certification in team facilitation and organizational communication. (See College of Education, Health, and Human Sciences – Department of Educational Psychology and Counseling catalog section for requirements.)

BIOSYSTEMS ENGINEERING

(See College of Agricultural Sciences and Natural Resources – Department of Biosystems Engineering and Soil Science)

Biosystems engineers use engineering science and mathematics to address opportunities and problems in biological, environmental, ecological, and agricultural systems. This ABET accredited program is offered by the Department of Biosystems Engineering and Science in the College of Agricultural Sciences and Natural Resources in cooperation with the College of Engineering.

DEPARTMENT OF CHEMICAL ENGINEERING

http://www.che.utk.edu/

John R. Collier, Head
Fred E. Weber, Undergraduate Liaison

Professors

Bienkowski, P.R., PhD . . . . . .Purdue
Collier, J.R., PhD . . . . . .Case Institute of Technology
Counce, R.M., PhD . . . . . .Tennessee
Moore, C.F. (Distinguished Service Professor), PhD, PE . . . . . .Louisiana State
Sheth, Antul C. (UTSI), PhD . . . . . .Northwestern

Associate Professors

Bruns, D.D., PhD . . . . . .Houston
Edwards, B.J., PhD . . . . . .Delaware
Frymier, P.D., PhD . . . . . .Virginia
Keffer, D.J., PhD . . . . . .Minnesota
Petrovan, S. (Research), PhD . . . . . .Iasi Tech
Wang, T.W., PhD . . . . . .Massachusetts Institute of Technology
Weber, F.E., PhD . . . . . .Minnesota

Adjunct Faculty

Steele, W.V., PhD . . . . . .Queens (Belfast)

Emeriti Faculty

Holmes, J.M., PhD . . . . . .Tennessee
Prados, J.W., PhD, PE . . . . . .Tennessee

Chemical engineering deals with the development, design, operation, and management of plants and processes for economical, safe conversion of chemical raw materials to useful products. It is a broadly based discipline with heavy emphasis on chemistry and mathematics, with supporting study in areas such as physics, materials, and humanities.

Chemical engineering graduates of the University of Tennessee, Knoxville, possess the knowledge base, intellectual skills, and professional commitment that prepare them for innovative technical leadership, graduate study, productive service to society, and continued professional growth through lifelong learning. Preparation is based in the learning objectives identified below, regular evaluation of the achievement of these objectives, and use of evaluation results to improve the educational process.

- Graduates of the UT Knoxville chemical engineering program who enter professional practice will demonstrate a high level of technical competence, along with career progression toward positions of technical or managerial leadership.
- Graduates of the UT Knoxville chemical engineering program who pursue full-time graduate or advanced professional study will complete their programs of study successfully.
- Graduates of the UT Knoxville chemical engineering program will continue their professional growth through lifelong learning.

The curriculum provides a central core of required courses with flexibility in the upper-division years to permit emphasis on preparation for graduate school or professional employment. To graduate in chemical engineering, students must complete the published curriculum with a grade of C or better in all required chemical engineering courses.

A minimum of 18 hours of general education courses are required. These courses must meet the University General Education Requirement. A writing course (WC) and oral communication course (OC) must be included in the general education electives.

Honors Program

The honors program encourages highly-motivated students to experience a more rigorous preparation in chemical engineering. Admission is selective. Application to the honors program is made when the student applies for upper-division status. Honors requirements are credit for three of the four honors seminars (Chemical Engineering 307, 308, 407 and 408), Chemical Engineering 447, one of Chemical Engineering 467, 477, 488 or 498 as a technical elective and Chemistry 483 as a chemistry option. Students interested in the honors program should consult the department's Honors Coordinator.

Progression to Upper Division

Progression of chemical engineering students to departmental courses numbered 310 or above is competitive and is based on capacity. Factors considered include overall grade point average, performance in selected lower-division courses, and evidence of satisfactory and orderly progress through the prescribed curriculum.

Upper-Division Status

A lower-division student may apply for progression to upper-division status after completing Chemical Engineering 200, 230, 240 and 250 with a grade of C or better in each course and an overall GPA of 2.5 or better.

Provisional Status

Students who have completed Chemical Engineering 200, 230, 240, and 250 with an overall GPA of at least 2.1 may apply for provisional status. The granting of provisional upper-division status is based on the availability of space in the departmental programs after upper-division status students have been accommodated. Provisional students are required to demonstrate the ability to perform satisfactorily in upper-division courses by completing a total of seven departmental courses with a grade of C or better in each course (including the four required for upper-division status). Permission to continue with upper-division classes depends on this minimum level of performance.

Any student with an overall GPA below 2.1 will not be admitted to upper-division chemical engineering courses. Students who have not been admitted to upper-division or provisional status will be dropped from upper-division departmental class rolls.

Transfer Students

The upper-division level students are admitted on a provisional status basis only.

CHEMICAL ENGINEERING MAJOR

Requirements for Bachelor of Science in Chemical Engineering

First Year	Hours Credit
English 101*, 102*	6
Chemistry 120*, 130*	8
Mathematics 141*, 142*	8
Engineering Fundamentals 105, 151 or 157, 152 or 158	9
Second Year	
Chemical Engineering 200, 215, 230, 240, 250	16
Mathematics 200, 231, 241	8
Chemistry Option I	3
Arts and Humanities Electives*	6
Third Year	
Chemical Engineering 301, 310, 340, 360, 380	13
Chemistry 310-319	4
Chemistry 350	3
Chemistry Option II	3
[1]Technical Elective (OC)*	3
Social Sciences Electives*	6
Fourth Year	
Chemical Engineering 401, 410 or 411, 445, 450, 480, 488 or 490	17
Physics 231*	3
[1]Technical Electives (one course must be WC)*	6
Cultures and Civilizations Electives*	6
Total	128

* Meets University General Education Requirement.
All electives must be pre-approved by the advisor and the department head.

1 Students must meet the University General Education Requirement for Communicating through Writing and Communicating Orally by selecting a course with a WC designation and a course with an OC designation.

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

http://www.engr.utk.edu/civil/

Gregory D. Reed, Head

Professors

Bennett, R.M., PhD, PE . . . . . Illinois
Burdette, E.G. (Fred N. Peebles Professor), PhD, PE . . . . . Illinois
Chatterjee, A., PhD, PE . . . . . North Carolina State
Davis, W.T. (Associate Dean), PhD . . . . . Tennessee
Deatherage, J.H., PhD, PE . . . . . Tennessee
Drumm, E.C., PhD, PE . . . . . Arizona
Penumadu, D., PhD . . . . . Georgia Tech
Reed, G.D., PhD, PE . . . . . Arkansas
Robinson, R.B. (Fisher Professor), PhD, PE . . . . . Iowa State
Urbanik, T. (Condra Professor and Goodrich Chair), PhD, PE . . . . . Texas A&M

Associate Professors

Cox, C.D., PhD, PE . . . . . Penn State
Han, L.D., PhD . . . . . California (Berkeley)
Miller, T.L., PhD, PE . . . . . Tennessee
Richards, S.H., PhD, PE . . . . . Tennessee
Robinson, K.G., PhD . . . . . Virginia Tech

Assistant Professors

Agnihotri, S., PhD . . . . . Illinois
Gentry, R., PhD, PE . . . . . Memphis
Ma, Z., PhD, PE . . . . . Nebraska
Huang, B., PhD, PE . . . . . Louisiana State
Schwartz, J., PhD, PE . . . . . Illinois
Zhao, Q., PhD . . . . . California (Berkeley)

The department offers a Bachelor of Science Degree in Civil Engineering, accredited by the Accreditation Board for Engineering and Technology (ABET).

Undergraduate Education Mission

To prepare students to enter the general practice of civil engineering and/or pursue graduate education, the department's undergraduate education mission is to provide a high-quality teaching and learning environment in recognized areas of civil engineering with proficiency in environmental, geotechnical, structural, transportation, and water resources engineering.

Educational Objectives

Consistent with the mission of the Department of Civil and Environmental Engineering at the University of Tennessee, Knoxville, graduates of the civil engineering program will have technical competency to pursue professional practice or graduate education; and professional competency to function in a team environment, effectively communicate, and engage in life-long learning.

The curriculum in civil engineering provides training in fundamental engineering sciences and in basic subjects in related fields. Technical electives are available in construction, environmental engineering, geotechnical, material, structures, transportation, or water resources.

Graduation Requirements

Students are required to be advised every semester. Students are required to maintain a cumulative grade point of at least 2.00 in all civil engineering and environmental engineering courses taken at the University of Tennessee, Knoxville, used to satisfy the graduation requirements. No more than two civil and environmental engineering courses in which a D is the highest grade earned may be counted toward graduation.

Electives

Electives are chosen to meet student career objectives and program accreditation requirements. Students must consult with their advisor and have their selections pre-approved. A student must have a GPA of 2.75 or higher or approval of the instructor to take 500-level courses for undergraduate credit.

CIVIL ENGINEERING MAJOR

Requirements for the Bachelor of Science in Civil Engineering

First Year	Hours Credit
Chemistry 120*, 130*	8
English 101*, 102*	6
Engineering Fundamentals 105, 151 or 157, 152 or 158	9
Mathematics 141*, 142*	8
Second Year	
Arts and Humanities Elective*	3
Civil Engineering 205*, 210, 261	9
Cultures and Civilizations Elective*	3
Engineering Fundamentals 202	2
Mathematics 231, 241, 251	10
Physics 231*	3
Statistics 251	3
Third Year	
Arts and Humanities Elective*	3
Civil Engineering 305, 321, 330, 351, 352, 361, 380, 390, 416	27
Cultures and Civilizations Elective*	3
Fourth Year	
Civil Engineering 400, 401, 435, 440, 442, 471, 480	19
Civil Engineering Elective	3
Civil Engineering/Technical Elective	3
Social Sciences Electives*	6
Total	128

* Meets University General Education Requirement.
All electives must be pre-approved by the advisor and the department head.

Minor in Environmental Engineering

The College of Engineering offers a minor in environmental engineering to those undergraduate students whose academic history provides the prerequisites for the courses required by the minor. The minor requires the completion of a minimum of 21 credits in coursework which builds the foundation of an environmental engineering perspective. Some of the courses used in the minor may also satisfy a requirement for a major. Students are advised that the first professional degree in environmental engineering at the University of Tennessee, Knoxville, is the Master of Science with a major in environmental engineering which builds on the minor.

Students are asked to file their intent to complete the minor with the office of the Department of Civil and Environmental Engineering, 223 Perkins Hall. The student's home department advisor will then be supplied with the information about the minor requirements to assist with prerequisite sequencing. A copy of the form will be filed with the Office of the University Registrar so that, upon completion, the minor will be shown on the student's transcript.

Required Courses	**Hours Credit**
Civil Engineering 486	3
Microbiology 210	3
Select one from Chemistry 230, 310, or 350	3
Select two from Chemical Engineering 200; Biosystems Engineering 221; Civil Engineering 380, 395, 416	6
Select one from Geology 202 or Philosophy 245	3
Select one from Geology 485; Civil Engineering 485; Environmental or Soil Sciences 444	3
	Total 21

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

http://www.ece.utk.edu/

Samir El-Ghazaly, Head
Paul B. Crilly, Undergraduate Liaison

Professors

Abidi, M., PhD . . . . . Tennessee
Birdwell, J.D., PhD . . . . . Massachusetts Institute of Technology
Bomar, B.W. (UTSI), PhD . . . . . Tennessee
Bouldin, D.W., PhD . . . . . Vanderbilt
El-Ghazaly, S.M., PhD . . . . . Texas
Kuo, W. (Dean and University Distinguished Professor), PhD . . Kansas State
Lawler, J.S., PhD . . . . . Michigan State
Pace, M.O., PhD . . . . . Georgia Tech
Pujol, S.A., (UTSI), PhD . . . . . Vanderbilt
Roberts, M.J., PhD . . . . . Tennessee

Associate Professors

Crilly, P.B., PhD . . . . . New Mexico State
Fathy, A., PhD . . . . . Polytechnic Institute of New York
Islam, S.K., PhD . . . . . Connecticut
Qi, H., PhD . . . . . North Carolina State
Smith, L.M. (UTSI), PhD . . . . . Tennessee
Tolbert, L.M., PhD . . . . . Georgia Tech

Assistant Professors

Blalock, B.J., PhD . . . . . Georgia Tech
Djouadi, S. M., PhD . . . . . McGill (Canada)
Elhanany, I., PhD . . . . . Ben-Gurion (Israel)
Farquhar, E.D., PhD . . . . . Georgia Tech
Ferdjallah, M., PhD . . . . . Texas (Austin)
Kong, S.G., PhD . . . . . UCLA
Li, F., PhD . . . . . Virginia Tech
Peterson, G.D., DSc . . . . . Washington University
Wu, J., PhD . . . . . Notre Dame

Emeriti Faculty

Alexeff, I., PhD, PE . . . . . Wisconsin
Gonzalez, R.C., PhD . . . . . Florida
Green, W.L., PhD . . . . . Texas A&M
Roth, J.R., PhD . . . . . Cornell

The goals of the Bachelor of Science programs in electrical and computer engineering are to prepare students for entry into the profession; instill in students the capabilities required by the discipline, the recognition of the need to enhance the discipline, and the desire for life-long learning; and to equip students with a general knowledge of technical and non-technical disciplines so that they are prepared for further study in other fields including professional and graduate education.

The Bachelor of Science programs are based on a series of integrated courses. Students advance through the program in a sequential manner guided by prerequisite and co-requisite courses in the showcase curriculum. This integrated sequentially-developed program is highlighted by the systematic inclusion of the design process introduced in the sophomore year.

Program Educational Objectives

The educational objectives of the electrical and computer engineering programs include an understanding of the engineering sciences necessary to analyze and design complex devices and systems containing hardware and software components; a progression of design projects and tasks throughout the program; an understanding of probability and statistics, including applications, and discrete mathematics; an understanding of mathematics through differential and integral calculus; an understanding of the basic sciences including chemistry and physics; an understanding of advanced mathematics in the areas of differential equations, numerical analysis, linear algebra, and advanced calculus; an orderly student progression through the program; and achievement of the objectives of the thirteen program outcomes.

Program Outcomes

In addition to the eleven program outcomes listed in the College of Engineering section on National Accreditation, electrical and computer engineering program outcomes also include experience in using organizational skills in team management and negotiation; and ability to use creative and technical skills in analytical problem solving in the discipline and other engineering related fields. Both electrical and computer engineering programs are under continuous assessment and improvement based on Engineering Criteria 2000. The advisory committee to the department, which is made up of persons from industry, government, higher education students and recent graduates, and faculty, provides constituent input for setting program educational objectives and outcomes and establishing the requisite assessment modes for the program.

General

The courses of study for the Bachelor of Science in Electrical Engineering and the Bachelor of Science in Computer Engineering are structured to provide a foundation in both the basic sciences and the specialized areas of the respective discipline. The programs also have sufficient general education electives to enhance the cultural growth of the student and develop professionals with a strong social awareness. The faculty seeks to keep classes small enough to allow effective interaction with students.

The selection of general education elective courses is left to each student but must be made in accordance with established College of Engineering policy.

Generally, all sophomore- and junior-level courses taught in the department are taught at least twice per year. Senior-level courses are normally offered in either the fall or spring semester. Courses for which a senior course is a prerequisite will be normally offered in the spring semester with the prerequisite senior course being offered in the fall semester. In all courses which have prerequisites indicated, the prerequisite must be completed prior to enrollment in the course. This scheduling arrangement allows for flexibility since the student may elect the normal four-year schedule, an accelerated schedule, or choose to participate in the cooperative engineering program.

The Electrical and Computer Engineering Department maintains a number of laboratory facilities to support the undergraduate teaching program. The laboratories are devoted specifically to circuits and systems, communications, computer networks, digital systems, electronics, image processing, machinery, machines, and power electronics and drives. Microcomputer and personal computer facilities are provided within the department.

The Electrical and Computer Engineering Department requires at least a C in every Electrical and Computer Engineering course used for either of our undergraduate degrees and in every required mathematics or computer science course.

Progression of electrical and computer engineering undergraduate majors to the upper-division programs of the department is competitive and is based on the space available in the department. Factors considered in the decision include overall grade point average, grades earned in courses required in the lower-division curricula of the department and College of Engineering, and seriousness of purpose and interest in departmental programs as exemplified by regular and orderly progress through the prescribed curriculum without abuse of withdrawal and course repeat privileges.

Students who take Electrical and Computer Engineering 300 in the ECE department will be evaluated during the semester they are registered for it. Transfer students for whom ECE 300 transfer credit is given may take 9 semester hours in departmental courses before progression evaluation. All students, whether or not they transfer in, who are not accepted into the upper-division program of the department will either be put in a temporary probationary status or a non-progressed status in which they will not be permitted to register for any upper-division courses within the department.

COMPUTER ENGINEERING MAJOR

Students in the junior and senior years may choose from a wide spectrum of courses covering various aspects of electrical and computer engineering, computer science, and related fields. Students must meet the design, depth, and breadth requirements in the department in their selection of these courses. Students are encouraged to discuss an appropriate senior program with their advisors.

To be eligible for the Bachelor of Science in Computer Engineering, a student must achieve a cumulative grade point average of at least 2.0 in all electrical and computer engineering courses taken at the University of Tennessee, Knoxville. At least 30 hours of upper-division courses in electrical and computer engineering and computer science must be earned at the University of Tennessee, Knoxville.

Requirements for the Bachelor of Science in Computer Engineering

First Year	**Hours Credit**
English 101*, 102*	6
Chemistry 120*	4
Math 141*, 142*	8
[1]Engineering Fundamentals 151 or 157, 152 or 158, 105	9
Electrical and Computer Engineering 206	4
Second Year	
Mathematics 231, 241, 251	10
Physics 231*, 232*	7
Electrical and Computer Engineering 255, 313	7
Electrical and Computer Engineering 300	5
Computer Science 140	4
Third Year	
Electrical and Computer Engineering 315, 335	7
Computer Science 302, 360	6
Mathematics 300	3
Electrical and Computer Engineering 316, 342, 355, 395	10
[2]Philosophy 241*, 243*, or 244*	3
[2]Cultures and Civilizations Electives*	6
Fourth Year	
Electrical and Computer Engineering 451-453 or 451-455	6
Electrical and Computer Engineering 400*	5
[3]Computer Engineering Senior Electives	6
[2]Arts and Humanities Elective*	3
[2]Social Sciences Electives*	6
[1]Engineering Fundamentals 402	1
	Total 126

* Meets University General Education Requirements.

1 Engineering Fundamentals 157 and 158 are honors versions of Engineering Fundamentals and students in the Chancellor's Honors Program are not required to take Engineering Fundamentals 402.

2 Can be taken at any time.

3 Must be in Electrical and Computer Engineering courses. At most, one Computer Engineering Senior Elective can be from any 300-level Electrical and Computer Engineering courses. Approved Senior Electives are Electrical and Computer Engineering 325, 336, 341, 415, 416, 421, 422, 423, 431, 432, 441, 442, 443, 446, 453, 471, 472, 481 and 482.

ELECTRICAL ENGINEERING MAJOR

Students in the senior year may choose from a wide spectrum of courses covering all aspects of electrical and computer engineering. Students must meet the design, depth, and breadth requirements of the department in their selection of these courses. The design requirement is met through a major engineering design experience in Electrical and Computer Engineering 400, Senior Design, and through the design process being integrated into specified courses throughout the program. The depth requirement is met by taking two courses in one of the five core areas of communications, computers, electronics, power, and systems. The breadth requirement is met by taking courses in other core areas, or courses in computer vision, power electronics, and emerging technologies. Students are encouraged to discuss an appropriate senior program with their advisors.

To be eligible for the Bachelor of Science in Electrical Engineering, a student must achieve a cumulative grade point average of at least 2.0 in all electrical and computer engineering courses taken at the University of Tennessee, Knoxville. At least 30 hours of upper-division electrical and computer engineering courses, including Electrical and Computer Engineering 400, and courses to meet the depth, and breadth requirements of the department must be earned at the University of Tennessee, Knoxville.

Requirements for Bachelor of Science in Electrical Engineering

First Year	**Hours Credit**
English 101*, 102*	6
Chemistry 120*	4
Math 141*, 142*	8
[1]Engineering Fundamentals 151 or 157, 152 or 158, 105	9
Electrical and Computer Engineering 206	4
Second Year	
Mathematics 200, 231, 241	8
Physics 231*, 232*	7
Electrical and Computer Engineering 255, 313	7
Electrical and Computer Engineering 300	5
[2]Philosophy 241*, 243*, or 244*	3
Third Year	
Electrical and Computer Engineering 315, 325, 335, 341	14
Electrical and Computer Engineering 316, 336, 342, 355, 395	13
[2]Social Sciences Electives*	6
Fourth Year	
Electrical and Computer Engineering 400*	5
[3]Electrical Engineering Senior Electives	12
[4]Technical Electives	6
[2]Arts and Humanities Elective*	3
[2]Cultures and Civilizations Electives*	6
[1]Engineering Fundamentals 402	1
	Total 127

* Meets University General Education Requirement.
1 Engineering Fundamentals 157 and 158 are Honors versions of Engineering Fundamentals and students in the Chancellor's Honors Program are not required to take Engineering Fundamentals 402.
2 Can be taken at any time.
3 Acceptable Senior Electrical and Computer Engineering sequences: 415-416, 421-422, 431-432, 441-442, 443-446, 451-453, 451-455, 471-472, 481-482.
4 Chemistry 130; Industrial Engineering 405; Materials Science and Engineering 201, 410; Mechanical Engineering 231, 321, 331, 344; Nuclear Engineering 342.

ENGINEERING PHYSICS PROGRAM

Soren P. Sorenson, Director
Stuart B. Elston, Coordinator

Engineering physicists typically work in areas of applied science and emerging technology in which standard engineering practices are rapidly evolving to keep pace with advances in science; they are often involved in developing new engineering methods and principles. The goal of the engineering physics Bachelor of Science program is to prepare its students to apply the principles and problem-solving approaches of physics to the solution of engineering problems at the frontiers between science and technology by

- Providing students with a thorough knowledge of mathematics, science, and engineering science with an emphasis on the principles of physics and of the derived physical, chemical, and biological sciences as appropriate to individual career goals.
- Training students in the communication, team cooperation, and problem identification and solving skills needed to practice engineering art in the modern world.
- Preparing students through example and experience to apply those principles and skills to the design and conduct of experiments, to the analysis and interpretation of measured results, and to the design of components, processes, and systems that meet specific, identified needs.
- Instilling in students understanding and appreciation of the cultural, historical, societal, economic, and environmental contexts in which problems of engineering and science arise, and to promote commitment to seek solutions which achieve appropriate balance of cultural, social, and technical value.

The program in engineering physics is designed to fulfill the educational requirements for professional work in various fields of applied science which are based upon a thorough knowledge of physics. The first two years of the curriculum are concerned with fundamental courses in engineering, science, mathematics, and general education. In the upper division, the curriculum allows some choice of courses in engineering and in physics depending on the interest and career goals of the student. The undergraduate program is a complete, professional program, equipping the student for entry into a variety of work in industry and research. The program also leads to graduate work in either physics or engineering.

ENGINEERING PHYSICS MAJOR

Requirements for the Bachelor of Science in Engineering Physics

First Year	**Hours Credit**
English 101*, 102*	6
Mathematics 141*, 142*	8
Engineering Fundamentals 105, 151 or 157, 152 or 158	9
Chemistry 120*, 130*	8
Second Year	
Mathematics 231, 241	7
Computer Science 102	4
[1]Physics 137, 138	10
[2]Engineering/Technical Electives	3
Cultures and Civilizations Electives*	6
Third Year	
Physics 240, 321	6
Physics 311, 312	6
Physics 361	3
Physics 421	4
[2]Engineering/Technical Electives	6
Social Sciences Electives*	6
Fourth Year	
Physics 411, 412	6
Physics 431, 432	6
Physics 461	3
[2]Engineering/Technical Electives	12
Arts and Humanities Electives*	6
	Total 125

* Meets University General Education Requirement. Students and their advisors are cautioned to ensure that Engineering, Technical, and/or General Education elective course selections meet the University General Education Communicating through Writing (WC) and Communicating Orally (OC) requirements.
1 Transfer students from other engineering departments may substitute Engineering Fundamentals 152 for Physics 137, Physics 231 for Physics 138, and Physics 232 for Physics 240.
2 A total of 12 hours of engineering electives plus 9 hours of technical electives are required. Engineering electives should form a coherent group of courses taken in the College of Engineering. Technical electives may be taken in physics, engineering, mathematics, other physical sciences, or astronomy.

DEPARTMENT OF INDUSTRIAL AND INFORMATION ENGINEERING

http://www.engr.utk.edu/ie/

Adedeji B. Badiru, Head

Professors

Badiru, A.B., PhD, PE . . . . . Central Florida
Ding, F., PhD . . . . . North Carolina State
Garrison, G.W. (UTSI), PhD . . . . . North Carolina State
Kuo, W. (Dean and University Distinguished Professor), PhD . . Kansas State

Associate Professors

Aikens III, C.H., PhD . . . . . Tennessee
Hailey, M.L. (UTSI), PhD, PE . . . . . Texas Tech
Jackson, D.F., PhD, PE . . . . . Tennessee
Sawhney, R.S., PhD . . . . . Tennessee

Assistant Professors

Ford, R.E., PhD . . . . . Tennessee
Jeong, M., PhD . . . . . Georgia Tech
Kim, D., PhD . . . . . Florida
Kong, D., PhD . . . . . Penn State
Li, X., PhD . . . . . Arizona State

Research Faculty and Staff

Halstead, P.D., BS . . . . . State University of New York

Originally, the industrial engineering profession focused on manufacturing. Today's industrial engineer will be involved in the design of systems and processes to produce and deliver goods and services not only in manufacturing, but also in the service industries and government sectors of the economy. Today's

industrial engineer is concerned with the design of integrated systems involving people, materials, finances, equipment, processes, energy, and information, so that the overall system functions efficiently and human needs are adequately met. Industrial engineering is distinctive in two respects – the industrial engineer typically works on problems or systems which include human beings as a major variable and the industrial engineer is by definition a systems engineer, whose unique combination of skills can be applied to many working environments.

It is this emphasis on people, science, and technology that distinguishes industrial engineering from the other engineering disciplines. The industrial engineer's objective is to achieve the best possible results for the benefit of humankind in terms of safety, quality, and productivity. Industrial engineers create value through a total systems approach, scientific method, engineering design, and integration of new technologies. In common with all engineering disciplines, industrial engineering is based on mathematics and the physical sciences. However, industrial engineering also emphasizes the life sciences and social sciences. This concern for the human element leads to system designs that enhance the quality of life for all people, both as producers and consumers of products and services.

Career choices for industrial engineers range from retail distribution, banking, healthcare delivery, corporate management, municipal management, aerospace systems, research groups, government employment as well as manufacturing. In all areas of manufacturing, service, and government, there is increasing emphasis on the goal of improving quality and productivity. Industrial engineers work closely with the top management in these sectors to achieve this goal.

Industrial engineering graduates possess the knowledge, technical skills, and professionalism for their entry into industry or graduate study. They are prepared for life-long learning and for service to society. Many will achieve prominent roles in management.

Students majoring in industrial engineering are eligible to participate in the Engineering Cooperative Program and other student activities in the College of Engineering. Industrial engineering majors interested in the Engineering Cooperative Program should visit Office of Cooperative Engineering or consult with their faculty advisor.

NOTE – Any 400-level course required in the Bachelor of Science in Industrial Engineering program at the University of Tennessee, Knoxville, may not be used for graduate credit in the Master of Science degree program.

Goals

The goals of the industrial engineering undergraduate program are to prepare students to contribute to the profession of industrial engineering and to prepare them for further study, including professional and graduate education.

Objectives

The objectives of the industrial engineering program include enabling the students to obtain

- An understanding of fundamental engineering principles, mathematics, science, and statistics.
- An understanding of and an ability to apply the following concepts to the multi-faceted problems associated with the production of, maintenance, and delivery of goods and services; fundamental human factors which influence engineering design, the economic analysis of alternative design choices, introductory economics and accounting, quality control techniques, manufacturing processes and materials, production and inventory system design and control, the mathematical modeling and simulation of complex systems, and the design and installation of information acquisition and control systems.
- An ability to communicate effectively, both orally and in writing, to function on multi-disciplinary teams, to have a knowledge of pertinent contemporary issues, and to recognize the need for a commitment to life-long learning.

This curriculum emphasizes the knowledge and skills necessary to design integrated systems of people, materials, equipment and energy, such that the overall systems functions at an optimal level and such that the needs of human components of the system are met. The solid, broad base in engineering, combined with education in applying engineering methodology to traditionally non-engineering problem areas as provided through the industrial engineering curriculum, leads to participation by industrial engineers in an unlimited range of fields including retail distribution, banking, health care delivery, corporate management, municipal management, food industry, as well as traditional areas of manufacturing.

Outcomes

The eleven program outcomes listed in the College of Engineering section on National Accreditation are the accepted outcomes of the Industrial and Information Engineering Department.

INDUSTRIAL ENGINEERING MAJOR

Requirements for the Bachelor of Science in Industrial Engineering

First Year	**Hours Credit**
Chemistry 120*	4
English 101*, 102*	6
Mathematics 141*, 142*	8
Engineering Fundamentals 105, 151 or 157, 152 or 158	9
Engineering Fundamentals 202	2
General Education Elective*	3
Second Year	
Accounting 200	3
Statistics 251	3
Math 200, 231, 241	8
Physics 231*	3
Engineering Fundamentals 230	2
Industrial Engineering 202, 250	4
Materials Science and Engineering 201	3
Mechanical Engineering 231	3
Nuclear Engineering 203	3
Third Year	
Economics 201*	4
Electrical and Computer Engineering 301	3
Industrial Engineering 300, 301, 304, 405	12
Industrial Engineering 310, 330, 340, 350*	10
Legal Studies 244 *	3
Fourth Year	
Industrial Engineering 401, 402, 404, 406	10
Industrial Engineering 421, 422, 427, 450	10
[1]Technical Elective	3
General Education Electives*	9
	Total 128

* Meets General Education Requirement

* All General Education electives must be pre-approved by the advisor and the department head.

1 Technical electives must be taken from the Department of Industrial and Information Engineering list of approved courses or be approved by the advisor and the department head.

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

http://www.engr.utk.edu/mse/

George M. Pharr, Interim Head

Professors

Benson, R.S., PhD . . . . . .Florida State
Bhat, G.S., PhD . . . . . .Georgia Tech
Bresee, R.R., PhD . . . . . .Florida State
Collier, B.J., PhD . . . . . .Tennessee
Dahotre, N.B., PhD . . . . . .Michigan State
Egami, T., PhD . . . . . .Pennsylvania
George, E.P., PhD . . . . . .Pennsylvania
Hansen, M.G., PhD . . . . . .Wisconsin
Joy, D.C., DPhil . . . . . .Oxford (UK)
Liaw, P.K., PhD . . . . . .Northwestern
Lundin, C.D., PhD . . . . . .Rensselaer Polytechnic Institute
McHargue, C.J., PhD . . . . . .Kentucky
Nieh, T.G., PhD . . . . . .Stanford
Pedraza, A.J., PhD . . . . . .LaPlata (Argentina)
Pharr, G.M., PhD, PE . . . . . .Stanford
Simpson, M.L., PhD . . . . . .Tennessee
Spruiell, J.E., PhD . . . . . .Tennessee
Wadsworth, L.C., PhD . . . . . .North Carolina State

Associate Professors

Kit, K., PhD . . . . . .Delaware
Meek, T.T., PhD . . . . . .Ohio State
Morris, J.R., PhD . . . . . .Cornell
Rack, P.D., PhD . . . . . .Florida

Assistant Professors

Choo, H., PhD . . . . . .Illinois Institute of Technology
Gao, Y., PhD . . . . . .Princeton
Hu, B., PhD . . . . . .Chinese Academy of Sciences
Keppens, V., PhD . . . . . .Katholieke Universiteit Leuven (Belgium)
Rawn, C.J., PhD . . . . . .Arizona

Emeriti Faculty

Brooks, C.R., PhD . . . . . .Tennessee
Fellers, J.F., PhD . . . . . .Akron
Stansbury, E.E., PhD. . . . . .Cincinnati

Materials science and engineering is concerned with the science and technology needed to develop and apply materials for the benefit of society. The undergraduate program is designed to prepare students to undertake materials science and engineering careers or to enter graduate programs in this or related disciplines. The following specific educational objectives were established in consultation with our students, faculty, potential employers, and alumni to assure that students are well prepared to undertake careers or graduate programs and that our students graduate with an undergraduate education that will sustain them for their lifetime.

During the initial stages of their careers, graduates will be prepared to

- Apply knowledge of the fundamentals of physical and chemical sciences, mathematics, and engineering sciences in the practice of materials science and engineering or in advanced professional studies.
- Design components, systems, or processes and/or select materials for specific applications with consideration of economic, safety, environmental, and social issues.
- Apply professional skills in such areas as communication, problem solving, and experience in working in diverse teams, to the practice of materials engineering in contemporary and global environs.
- Use the general education component of their education for the appreciation of cultural and social values, for understanding the impact of engineering solutions on society, and for personal development.

These educational objectives are consistent with the mission statement of the university. They particularly relate to “commitment to the development of individuals and society as a whole through the cultivation and enrichment of the human mind and spirit.” They are consistent with EAC/ABET General Criteria to assure quality and stimulate improvement.

The field of materials science and engineering is quite broad, encompassing metallic, ceramic and polymeric materials, as well as composites made from combinations of materials and specialty application areas such as electronic and optical materials.

Consequently the curriculum contains a central core of courses that are applicable to all materials types with flexibility in the upper division years to permit concentration and in-depth coverage of specific materials categories. By judicious choice of electives the student may get a broad perspective or may develop a specialty area.

A minimum of 18 semester-hours of general education courses are required by all engineering degree programs in order to meet the University of Tennessee, Knoxville, General Education goals. (See The University General Education Requirement section in the front of this catalog). The major in materials science and engineering specifically requires Economics 201 (taken as one of the two courses required in the Social Sciences cluster); any two approved courses under the Arts or Humanities cluster; and any two approved courses under the Cultures and Civilizations cluster. The requirement for three courses in writing communication may be filled by English 101 and 102 plus Materials Science and Engineering 405 (or other approved writing intensive course). The requirement for one course in communicating orally may be filled with Materials Science and Engineering 489 (or other approved communicating orally course).

Graduation in materials science and engineering requires a minimum grade point average of 2.00 for all departmental courses.

Progression to Upper-Division Programs

Progression of students to departmental upper-division courses is competitive. Factors considered include overall grade point average, performance in selected lower-division courses and evidence of satisfactory and orderly progress through the prescribed curriculum.

Upper-Division Status

A lower-division student formally applies for upper-division status after completing 50 hours of lower-division engineering curriculum course work with an overall GPA of at least 2.4. This must include Materials Science and Engineering 201.

Provisional Status

Students who have completed 50 hours of lower-division engineering curriculum coursework with an overall GPA between 2.0 and 2.4 may apply for provisional status. The granting of provisional upper-division status is based on the availability of space in the departmental programs after upper-division status students have been accommodated. Provisional students are required to demonstrate their ability to perform satisfactorily in upper-division courses by attaining a minimum GPA of 2.0 in at least 8 hours of 300-level required courses specified by the department. Further progression to upper-division courses is dependent upon this minimum level of performance.

Transfer Students

At the upper-division level students are admitted on a provisional status basis only. Any student presenting more than 28 hours of lower-division engineering curriculum coursework by transfer credit is considered to be a transfer student.

MATERIALS SCIENCE AND ENGINEERING MAJOR

Requirements for the Degree of Bachelor of Science in Materials Science and Engineering

First Year	Hours Credit
Materials Science and Engineering 101	1
English 101*, 102*	6
Chemistry 120*, 130*	8
Mathematics 141*, 142*	8
Engineering Fundamentals 105, 151 or 157, 152 or 158	9
Second Year	
Materials Science and Engineering 201, 250, 260, 290, 291	11
Physics 231*, 232*	7
Mathematics 200, 231, 241	8
[1]General Education Electives*	6
Third Year	
Materials Science and Engineering 300, 301, 302, 304, 320, 340, 350, 360, 370, 390	26
[1]General Education Elective*	3
Technical Elective	3
Fourth Year	
Materials Science and Engineering 405*(WC), 480, 489	10
[2]Materials Science and Engineering Electives	6
Electrical and Computer Engineering 301	3
Engineering Fundamentals 402	1
Technical Elective	3
[1]General Education Electives*	9
	Total 128

* Meets University General Education Requirement.

1 General Education courses must include Economics 201, any two approved courses under the Arts or Humanities cluster, any two approved courses under the Cultures and Civilizations cluster, and one approved course in the Social Sciences cluster.

2 Materials Science and Engineering electives: 410, 421, 429, 445, 470, 472, 474, 484, 494, 495.

NOTE: Students must meet the University General Education Requirement for Communicating Orally by selecting a course with an OC designation.

Minor in Materials Science and Engineering

A minor in materials science and engineering is offered through the College of Engineering to those undergraduate students who have met the prerequisites for the courses required by the minor. The minor requires completion of a minimum of 18 hours in coursework which develops a foundation in materials science and engineering and allows concentration in materials science and engineering areas to be selected by the students (e.g., metallurgy, polymers, ceramics, composites, or electronic materials). Some of the courses used for the materials science and engineering minor may also satisfy requirements for the student's major.

Students may enroll in the minor program by completing a form at the Department of Materials Science and Engineering, 434 Dougherty Engineering Building. A copy of the completed enrollment form and information on the minor requirements will be forwarded to the student's home department advisor. A copy of the form also will be filed with the Office of the University Registrar so that, upon completion, the minor will be shown on the student's transcript.

Required Courses	Hours Credit
Materials Science and Engineering 201 and 480	6
Choose at least one: Materials Science and Engineering 320, 340, 360, 402, 410, and 472	3
Select at least three, at least one of which must be at the 400-level – any of the Materials Science and Engineering 300-400 courses; Biomedical Engineering 310, 408, 455, 469, 473 and 475; Chemistry 350, 360, 369, 430, 439, 450, 473, 483, 479, 489 and 490; Chemical Engineering 230, 301, 447 and 484; Civil and Environmental Engineering 321 and 421; Electrical and Computer Engineering 335; Industrial Engineering 330, 401, and 484; Mechanical Engineering 321, 366, 466 and 484; Nuclear Engineering 484; Physics 342, 411, 412, 421, 431 and 432. Other courses in this category may be acceptable, but must be approved in advance by the Department of Materials Science and Engineering.	9
	Total 18

DEPARTMENT OF MECHANICAL, AEROSPACE, AND BIOMEDICAL ENGINEERING

http://www.engr.utk.edu/mabe/

William R. Hamel, Head

Professors

Arimilli, R.V., PhD . . . . . Virginia Tech
Baker, A.J., PhD, PE . . . . . New York
Dareing, D.W., PhD, PE . . . . . Illinois
Frankel, J.I., PhD . . . . . Virginia Tech
Hamel, W.R., PhD . . . . . Tennessee
Jendrucko, R.J., PhD, PE . . . . . Virginia
Johnson, W.S., PhD, PE . . . . . Clemson
Keyhani, M., PhD . . . . . Ohio State
Kihm, K.D., PhD . . . . . Stanford
Komistek, R.D., PhD . . . . . Memphis
Landes, J.D., PhD, PE . . . . . Lehigh
Milligan, M.W., PhD, PE . . . . . Tennessee
Parang, M. (Associate Dean), PhD, PE . . . . . Oklahoma
Parsons, J.R., PhD, PE . . . . . North Carolina State
Smith, G.V., PhD, PE . . . . . Penn State
Soliman, O., PhD, PE . . . . . Tennessee
Wasserman, J.F., PhD, PE . . . . . Cincinnati
Weitsman, Y.J. (Distinguished Professor), PhD . . . . . Rensselaer Polytechnic Institute

Associate Professors

Boulet, J.A.M., PhD . . . . . Stanford
Chellaboina, V.S., PhD . . . . . Georgia Tech
Lumsdaine, A., PhD . . . . . Michigan
Lyne, J.E., MD, PhD . . . . . North Carolina State
Madhukar, M.S., PhD . . . . . Drexel
Nguyen, K., PhD . . . . . Colorado
Pionke, C.D., PhD, PE . . . . . Georgia Tech

Assistant Professors

DeSmidt, H.A., PhD . . . . . Penn State
English, A., PhD . . . . . Harvard-MIT
Karpov, E.G., PhD . . . . . Southampton (UK)
Lee, D., PhD . . . . . Minnesota
Mahfouz, M.R., PhD . . . . . Colorado School of Mines

Emeriti Faculty

Carley, T.G., PhD, PE . . . . . Illinois
Forrester, J.H., PhD, PE . . . . . Iowa State
Hodgson, J., PhD, PE . . . . . Georgia Tech
Mathews, A., PhD, PE . . . . . Illinois
Shannon, T.E., PhD, PE . . . . . Tennessee
Snyder, W.T., PhD . . . . . Northwestern
Speckhart, F.H., PhD, PE . . . . . Georgia Tech

The department offers a Bachelor of Science in Mechanical Engineering, Aerospace Engineering, and Biomedical Engineering. The mission of the department is to provide a broad base integration of courses and experiences that prepare graduates to practice their profession successfully, to apply their skills to solve current engineering problems collaboratively, and to help advance the knowledge and engineering practice in their fields.

Progression

The freshman year curriculum is common to all engineering majors. The sophomore curriculum is nearly identical for all students in the department. The first two years are considered to be lower-division and the two remaining years upper-division. Upon completion of the lower-division courses, the student must apply for progression to the upper-division in order to continue in the department. Students allowed to progress may be awarded full status or provisional status. Factors considered include overall grade point average, performance in lower division engineering and mathematics courses, and evidence of orderly progression through the lower-division curriculum.

Full Status

A lower-division student may apply for progression to upper-division after completing 47 hours of lower-division engineering curriculum course work with an overall GPA of at least 2.4.

Provisional Status

Students who have completed 47 hours of lower-division engineering curriculum course work with an overall GPA between 2.0 and 2.4 may apply for provisional status. The granting of provisional status is based on the availability of space in departmental programs after full status students have been accommodated. Provisional status students are required to demonstrate their ability to perform satisfactorily in upper-division by attaining a minimum GPA of 2.0 in the first 12 hours of 300-level required engineering courses. Award of upper-division full status is dependent upon this performance.

Students with an overall GPA less than 2.0 in 47 hours of lower-division engineering curriculum course work will not be admitted to upper-division. Students who have not progressed to upper-division will be dropped from departmental class rolls.

Transfer Students

Students transferring more than 26 hours from another institution are considered transfer students. Students transferring 47 hours or more will be admitted to upper-division, if eligible, with provisional status.

Loss of Full Status

Full status students are expected to maintain an overall GPA of 2.0 and a GPA of 2.0 in departmental courses. Failure to maintain these levels of performance will result in a review of the student's progress and possible loss of full status.

Graduation Requirements

A minimum cumulative GPA of 2.0 in all departmental courses taken at the University of Tennessee, Knoxville, is required for graduation. This is in addition to the university's graduation requirements.

AEROSPACE ENGINEERING MAJOR

Aerospace engineering uses the basic sciences and mathematics to develop the foundation for the design, development, production, testing, and applied research associated with aerospace vehicles. These vehicles include aircraft, spacecraft, and missiles. Auxiliary and propulsion systems are also an integral part of this education. These include guidance, control, environmental, ramjet, rocket, turbo-jet, and piston engine systems. Emphasis in the senior year is directed toward these topics, and the program culminates in a major aerospace design project.

The educational objectives of the aerospace engineering program are

- To provide students with a comprehensive education that includes in-depth instruction in aerodynamics, structures, flight mechanics, orbital mechanics, flight propulsion, and the design of aerospace systems.
- To prepare students for professional careers in aerospace engineering by developing the skills pertinent to problem solving, analysis, design, and those personal skills required for teamwork and effective communication.
- To provide opportunities to develop and cultivate life-long learning skills, individual professionalism and ethics.
- To prepare some students for graduate study at major universities limited by student desire and their mental ability and agility.

Requirements for the Bachelor of Science in Aerospace Engineering

First Year	**Hours Credit**
English 101*, 102*	6
Chemistry 120*	4
Mathematics 141*, 142*	8
Engineering Fundamentals 105, 151 or 157, 152 or 158, 202	11
[1]Social Sciences Elective*	3
Second Year	
Mathematics 200, 231, 241	8
Aerospace Engineering 201	1
Physics 231*, 232	7
Mechanical Engineering 231, 321, 391	9
Materials Science and Engineering 201	3
Engineering Fundamentals 230	2
Economics 201*	4
Third Year	
Aerospace Engineering 341, 345, 351, 363, 370	16
Mechanical Engineering 331, 344, 363	9
Electrical and Computer Engineering 301	3
Philosophy 241*	3
[1]Arts and Humanities Elective*	3
Fourth Year	
Aerospace Engineering 410*, 422, 424, 425, 426, 429, 449	21
Engineering Fundamentals 402	1
[1]Cultures and Civilizations Electives*	6
	Total 128

* Meets University General Education Requirement.
1 Choose from the University General Education list.

Minor in Aerospace Engineering

A coursework program leading to a minor in aerospace engineering for students in other engineering degree programs is also offered.

Aerospace Engineering 341, Mechanical Engineering 231, 321, and 332 or equivalent background are prerequisites to a minor in aerospace engineering. The minor consists of five of the following six aerospace engineering courses: 351 (3), 363 (3), 370 (4), 422 (3), 424 (4), and 425 (4). The grade in each of the aerospace engineering courses must be at least C. Prerequisites will be checked the first day of class every term for each of the aerospace engineering courses.

BIOMEDICAL ENGINEERING MAJOR

The biomedical engineering curriculum integrates selected engineering sciences and design methods with life science coursework. The program prepares students for careers in a variety of health care related professions including work for medical device manufacturers and regulatory governmental agencies. The course content of the biomedical engineering curriculum complements the departmental strengths in mechanical engineering and includes a comprehensive coverage of engineering materials and biomechanics applications. Elective courses are

available to allow students to specialize their curriculum to areas of particular current interest in the marketplace such as cellular and tissue engineering applications. The biomedical engineering program also allows students to meet medical school admission requirements with an appropriate selection of technical electives.

The educational objectives of the biomedical engineering program are

- To provide students with a solid foundation in mathematics, the basic and engineering sciences and engineering design methods.
- To provide students with a comprehensive integration of engineering methods of problem-solving and design with the biological sciences.
- To develop the skills needed for work in the medical device industry including a thorough coverage of engineering materials, biomaterials, biomechanics, medical device design, and work in interdisciplinary teams.
- To provide essential laboratory experience with commonly used biomedical devices and systems and to provide coverage of methods for the design of experiments in medical and life science applications.
- To provide a biomedical technology-based engineering background for students desiring admission to medical school with admission requirements being met through the appropriate selection of elective coursework.

Requirements for the Bachelor of Science in Biomedical Engineering

First Year	**Hours Credit**
English 101*, 102*	6
Chemistry 120*, 130*	8
Mathematics 141*, 142*	8
Engineering Fundamentals 105, 151 or 157, 152 or 158, 202	11
Second Year	
Engineering Fundamentals 230.	2
Physics 231*, 232*	7
Mathematics 200, 231, 241	8
Mechanical Engineering 231, 321	6
Biology 140	4
[1]Cultures and Civilizations Elective*	3
Biomedical Engineering 271	3
Third Year	
Electrical and Computer Engineering 300, 315	8
Aerospace Engineering 341	3
Biomedical Engineering 300, 310, 320	8
Mechanical Engineering 331	3
Philosophy 241*	3
Materials Science and Engineering 201	3
Economics 201*	4
Fourth Year	
Engineering Fundamentals 402	1
Biomedical Engineering 410*, 430, 455, 469	11
[1]Cultures and Civilizations Elective*	3
[2]Technical Elective	3
[2]Departmental Elective	3
[1]Arts and Humanities Elective*	3
[1]Social Sciences Elective*	3
Statistics 251	3
	Total 128

* Meets University General Education Requirement.
1 Choose any course from the University General Education list.
2 Departmental and technical electives must be pre-approved by the advisor and department head.

MECHANICAL ENGINEERING MAJOR

Mechanical engineering involves the design, analysis, testing, and manufacture of mechanical and thermal systems. Mechanical engineers are employed in nearly every industry, from basic research through mass production of energy systems, computer software/hardware, robotics, and automobiles.

Mechanical engineering is a versatile and broadly based engineering discipline that also provides pathways into many exciting fields of specialization. Its foundation is in the basic sciences, but mechanical engineers must further understand such subject areas as mechanical design, solid and fluid mechanics, thermodynamics, heat transfer, vibrations, manufacturing processes, instrumentation and automatic control. Design projects throughout the curriculum develop student skills in handling practical real-world problems. Because of the broad engineering foundation and design training in this program, graduates are found in nearly every industry and at different levels of research, design, and management.

The educational objectives of the mechanical engineering program are

- To educate students thoroughly in methods of analysis, including mathematical and computational skills appropriate for application to engineering problems.
- To develop the skills pertinent to the design process, including skills needed for formulation of problems, analysis, synthesis, and skills pertinent to effective communication and collaborative work.
- To teach students to use modern experimental and data analysis techniques for engineering application.
- To prepare students for lifelong learning, nourish creative talents, and provide understanding of professional and ethical responsibilities.

Requirements for the Bachelor of Science in Mechanical Engineering

First Year	**Hours Credit**
English 101*, 102	6
Chemistry 120*	4
Mathematics 141*, 142*	8
Engineering Fundamentals 105, 151 or 157, 152 or 158, 202	11
[1]Cultures and Civilizations Elective*	3
Second Year	
Mathematics 231, 241, 251	10
Engineering Fundamentals 230	2
Physics 231*	3
Mechanical Engineering 231, 321, 391	9
Materials Science and Engineering 201	3
Economics 201*	4
[1]Cultures and Civilizations Elective*	3
Third Year	
Mechanical Engineering 331, 344, 345, 363, 366, 466	18
Electrical and Computer Engineering 301	3
[2, 3]Departmental Elective	3
Aerospace Engineering 341	3
[1]Arts and Humanities Elective*	3
Fourth Year	
Mechanical Engineering 410*, 475, 449, 450, 460	13
Engineering Fundamentals 402	1
Mechanical Engineering 365 or 463	3
[3]Technical Elective	3
[2, 3]Departmental Electives	6
Philosophy 241*	3
[1]Social Sciences Elective*	3
	Total 128

* Meets University General Education Requirement.
1 Choose any course from the University General Education list.
2 Must be chosen from Aerospace Engineering 351, 363, 422, 425; Mechanical Engineering 365, 406, 451,452, 457, 463, 467, 480 or other departmentally approved course.
3 All departmental and technical electives must be pre-approved by the advisor and department head.

DEPARTMENT OF NUCLEAR ENGINEERING

www.engr.utk.edu/nuclear

H.L. Dodds, Head

Professors

Dodds, H.L. (IBM Professor), PhD, PE . . . . . .Tennessee
Fontana, M.H. (Research), PhD, PE . . . . . .Purdue
Grossbeck, M.L. (Research), PhD . . . . . .Illinois
Hines, J.W., MBA, PhD . . . . . .Ohio State
Mihalczo, J.T. (Research), PhD . . . . . .Tennessee
Miller, L.F., PhD, PE . . . . . .Texas A&M
Mynatt, F.R. (Research), PhD . . . . . .Tennessee
Pettengill, H.J. (Research), PhD . . . . . .Michigan
Ruggles, A.E., PhD . . . . . .Rensselaer Polytechnic Institute
Townsend, L.W., PhD . . . . . .Idaho
Upadhyaya, B.R., PhD, PE . . . . . .California (San Diego)

Associate Professors

Pevey, R.E., MBA (Emory), PhD, PE . . . . . .Tennessee
Scott, T.H., PhD, PE . . . . . .Florida

Assistant Professors

Gribok, A.V. (Research), PhD . . . . . .IPPE (Russia)
Moussa, H.M. (Research), PhD . . . . . .Tennessee
Stephan, A.C. (Research), PhD . . . . . .Tennessee

Adjunct Faculty

DeHart, M.D., PhD . . . . . .Texas A&M
Gehin, J.C., PhD . . . . . .Massachusetts Institute of Technology
Icenhour, A.S., PhD . . . . . .Tennessee
Nichols, T.L., MD . . . . . .Tennessee
Ramsey, C.R., PhD . . . . . .Tennessee

Emeriti Faculty

Groer, P.G., PhD . . . . . .Vienna (Austria)
Uhrig, R.E. (Distinguished Professor), PhD, PE . . . . . .Iowa State

Nuclear engineering is the engineering discipline that focuses on the application of nuclear and atomic processes for the benefit of mankind and the environment. Radiological engineering is a specialty of nuclear engineering that addresses biological applications such as radiation safety (health physics). Some examples of nuclear and radiological engineering are production of electric power with essentially no air pollution, production of radioisotopes for medical and industrial uses, and development of radiation based methods for the diagnosis and treatment of cancer.

The mission of the Nuclear Engineering Department is to

- Produce high quality nuclear and radiological engineering graduates from undergraduate through the doctoral level in order to help meet the manpower needs of our state, region, nation, and the international community.
- Conduct nuclear and radiological engineering related research to help meet the needs of society.
- Perform service for industry, government, professional organizations, and the public in areas related to nuclear and radiological engineering.

The program for the Bachelor of Science in Nuclear Engineering is nationally accredited by the Accreditation Board for Engineering and Technology (ABET) which is described earlier in this catalog. The educational objectives of the Bachelor of Science program are to

- Provide students with fundamental knowledge in mathematics, computer science, the basic sciences, and the engineering sciences that is necessary to solve state-of-the-art problems in nuclear and radiological engineering.
- Provide students with a real-world design and analysis experience in nuclear and radiological engineering that shall include environmental, societal, safety, and economic considerations.
- Provide students with appropriate skills in oral and written communication, teamwork, laboratory work, problem solving and the use of modern engineering tools that will prepare them to work productively in a contemporary and global environment.
- Provide students with a diverse general education in the humanities, ethics, and social sciences to compliment their technological education in order to understand and appreciate the importance of each in society and in personal development.
- Foster a genuine desire for life-long learning in students.

Students majoring in nuclear engineering take courses in the basic sciences, engineering fundamentals, mathematics, computer science, humanities, and special areas of nuclear engineering including nuclear system design and safety; radiation transport and shielding; heat transfer and fluid flow; instrumentation and controls; fuel cycle and waste management; and health physics. Nuclear engineering students may concentrate in radiological engineering by substitution of three courses. The radiological engineering concentration also satisfies most of the requirements of pre-med, pre-vet, and pre-dentistry programs.

NUCLEAR ENGINEERING MAJOR

Requirements for the Bachelor of Science in Nuclear Engineering

First Year	**Hours Credit**
Chemistry 120*, 130*	8
English 101*, 102*	6
Engineering Fundamentals 105, 151 or 157, 152 or 158	9
Mathematics 141*, 142*	8
Second Year	
Arts and Humanities Elective*	3
Economics 201* or 207*	4
Electrical and Computer Engineering 301	3
Engineering Fundamentals 202, 230	4
Mathematics 231, 241	7
Nuclear Engineering 200, 203	4
Physics 231*, 232*	7
Third Year	
Cultures and Civilizations Elective*	3
Mathematics 403	3
Nuclear Engineering 301, 304*, 342, 351, 360, 431, 470	21
Physics 341	3
Social Sciences Elective*	3
Fourth Year	
Cultures and Civilizations Elective*	3
Engineering Fundamentals 402	1
Materials Science and Engineering 201	3
Mechanical Engineering 321	3
Nuclear Engineering 400*, 403*, 406, 472	11
Philosophy 241*, 243*, or 244*	3
[1]Technical Electives	6
	Total 126

* Meets University General Education Requirement.

[1] Technical electives are selected from upper-division mathematics and engineering courses and must be pre-approved by the department.

RADIOLOGICAL ENGINEERING CONCENTRATION

Requirements for the Bachelor of Science in Nuclear Engineering • Radiological Engineering Concentration

First Year	**Hours Credit**
Chemistry 120*, 130*	8
English 101*, 102*	6
Engineering Fundamentals 105, 151 or 157, 152 or 158	9
Mathematics 141*, 142*	8
Second Year	
Arts and Humanities Elective*	3
Economics 201* or 207*	4
Electrical and Computer Engineering 301	3
Engineering Fundamentals 202, 230	4
Mathematics 231, 241	7
Nuclear Engineering 200, 203	4
Physics 231*, 232*	7

Third Year

Biology 140	4
Cultures and Civilizations Elective*	3
Mathematics 403	3
Nuclear Engineering 301, 304*, 342, 351, 431, 470	18
Physics 341	3
Social Sciences Elective*	3

Fourth Year

Biochemistry and Cellular and Molecular Biology 230	5
Cultures and Civilizations Elective*	3
Engineering Fundamentals 402	1
Mechanical Engineering 321	3
Nuclear Engineering 400*, 403*, 406, 472	11
Philosophy 241*, 243*, or 244*	3
Statistics 251; Biochemistry and Cellular and Molecular Biology 310; or Chemistry 350	3
[1]Technical Elective	3
Total	129

* Meets University General Education Requirement.

[1] Technical electives are selected from upper-division mathematics, chemistry, and engineering courses and must be pre-approved by the department. Pre-med, pre-vet, and pre-dentistry students must also take Chemistry 360 and Chemistry 369.