

Nuclear Engineering

College of Engineering (<http://coe.berkeley.edu>)

**Department Office: 4153 Etcheverry Hall,
(510) 642-5010**

Chair: Karl van Bibber, PhD

Department Website: Nuclear Engineering (<http://www.nuc.berkeley.edu>)

Overview

Nuclear engineering is concerned with the applications of nuclear reactions and radiation to biomedical devices, energy systems, and environmental concerns and issues. The scope of the field includes the design, analysis, and operation of nuclear reactors and their nuclear fuel cycles, devices for the detection, prevention, and treatment of disease, and systems for the treatment and disposal of high-level radioactive waste. The principles taught in the nuclear engineering courses are applicable both to nuclear fission reactors and to the development of nuclear fusion as an energy source. The nuclear engineering courses deal with the physical principles of nuclear reactions, the interaction of nuclear radiation with matter, the behavior of neutrons in reactor media, the thermal and hydrodynamic principles of heat extraction, the properties of nuclear materials, and operations and processes in nuclear fuel cycles, reactor design, and thermonuclear fusion. These subjects are taught in courses at the undergraduate and graduate levels. Other courses include radiation protection, environmental effects, nuclear safety, risk analysis, high-level radioactive waste disposal, medical imaging, biophysics, and biomedical devices.

See the "College of Engineering Undergraduate Guide" (<http://coe.berkeley.edu/guide>) and our website (<http://www.nuc.berkeley.edu>) for more information.

Undergraduate Program

Undergraduates can major in general nuclear engineering or the nuclear engineering joint major programs. Students can major in the joint major programs beginning in their junior year. The joint major programs are jointly offered through nuclear engineering and the following fields of engineering: mechanical, electrical, materials science, or chemical. Graduate programs leading to the master's and doctoral degrees involve advanced coursework in nuclear engineering and in allied fields and direct participation in research under supervision of the nuclear engineering faculty.

The BS program is accredited in nuclear engineering by the Engineering Accreditation Commission of the ABET, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; (410) 347-7700.

Major Requirements

Students must complete a minimum of 120 units, in which they must satisfy the University of California and UC Berkeley campus requirements outlined in this Bulletin. In addition, students must complete the requirements for the College of Engineering and the general nuclear engineering program. Full details on these requirements are found in the "College of Engineering Undergraduate Guide" (<http://coe.berkeley.edu/guide>) and our website (<http://www.nuc.berkeley.edu>) for more information.

Graduate Study

Admission to the graduate program in nuclear engineering is available to qualified individuals who have obtained a bachelor's degree from a recognized institution in one of the fields of engineering or the physical sciences. For all programs, required preparation in undergraduate coursework includes mathematics through partial differential equations and advanced analysis, nuclear reactions, and thermodynamics. Admission is granted on the basis of undergraduate and graduate records (if any), statement of purpose, record of work experience and professional activities, letters of recommendation, and the Graduate Record Examination (GRE) and Test of English as a Foreign Language (TOEFL), if applicable. The graduate program is divisible into 11 areas, each representing an important aspect of nuclear technology: applied nuclear physics; bionuclear and radiological physics; nuclear materials and chemistry; energy and the environment; fission reactor analysis; fusion science and technology; nuclear thermal hydraulics; laser, particle beam, and plasma technologies; fuel cycles and radioactive waste; risk, safety, and systems analysis; and ethics and the impact of technology on society. Coursework and research opportunities are available in each area. A program of study is selected for each individual student. The program is chosen so that qualified students make maximum progress in preparation for the doctoral examinations while gaining valuable experience in engineering research for both the master's (MS or MEng) and doctoral (PhD or DEng) programs. Further information may be obtained from the Department of Nuclear Engineering Graduate Office, 4149 Etcheverry Hall and on our website. (<http://www.nuc.berkeley.edu>)

Note: In addition to the courses listed under the Department of Nuclear Engineering, the department also offers the following courses found in the Engineering (http://sis.berkeley.edu/catalog/gcc_view_req?p_dept_cd=ENGIN) section of this Bulletin: Eng 115 (Engineering Thermodynamics) and Eng 117 (Engineering Analysis).

NUC ENG 24 Freshman Seminars 1 Unit**Department:** Nuclear Engineering**Course level:** Undergraduate**Terms course may be offered:** Fall and spring**Grading:** The grading option will be decided by the instructor when the class is offered.**Hours and format:** 1 hour of Seminar per week for 15 weeks.

The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.

Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

NUC ENG 92 Issues in Nuclear Science and Technology 2 or 3 Units**Department:** Nuclear Engineering**Course level:** Undergraduate**Term course may be offered:** Fall**Grading:** Letter grade.**Hours and format:** 2 hours of lecture and 1 hour of discussion (optional) per week.

Introduction to technical, social, institutional, and ethical issues in nuclear engineering; nuclear reactions and radiation, radiation protection and control, nuclear energy production and utilization, nuclear fuel cycle, reactor safety, controlled fusion, nuclear waste, medical and other applications of radiation, nuclear nonproliferation and arms control and engineering ethics. Nuclear Engineering majors must enroll in 3 units; discussion section and design project required. Non-majors may take course for 2 or 3 units. Discussion section and design project not required for 2 units.

Formerly known as 39A.

NUC ENG 100 Introduction to Nuclear Engineering 3 Units**Department:** Nuclear Engineering**Course level:** Undergraduate**Term course may be offered:** Fall**Grading:** Letter grade.**Hours and format:** 3 hours of lecture per week.**Prerequisites:** Physics 7A and 7B, Physics 7C may be taken concurrently. Mathematics 53 and 54 may be taken concurrently.

The class provides students with an overview of the contemporary nuclear energy technology with emphasis on nuclear fission as an energy source. Starting with the basic physics of the nuclear fission process, the class includes discussions on reactor control, thermal hydraulics, fuel production, and spent fuel management for various types of reactors in use around the world as well as analysis of safety and other nuclear-related issues. This class is intended for sophomore NE students, but is also open to transfer students and students from other majors.

NUC ENG 101 Nuclear Reactions and Radiation 4 Units**Department:** Nuclear Engineering**Course level:** Undergraduate**Term course may be offered:** Fall**Grading:** Letter grade.**Hours and format:** 4 hours of Lecture per week for 15 weeks.**Prerequisites:** Physics 7C.

Energetics and kinetics of nuclear reactions and radioactive decay, fission, fusion, and reactions of low-energy neutrons; properties of the fission products and the actinides; nuclear models and transition probabilities; interaction of radiation with matter.

Instructor: Norman

NUC ENG 102 Nuclear Reactions and Radiation Laboratory 3 Units**Department:** Nuclear Engineering**Course level:** Undergraduate**Term course may be offered:** Spring