# Industrial Engineering and Operations Research

## College of Engineering (http://coe.berkeley.edu)
## Department Office: 4141 Etcheverry Hall, (510) 642-5484

### Chair: Phil Kaminsky, PhD
### Department Website: Industrial Engineering and Operations Research (http://ieor.berkeley.edu)

#### Overview

Industrial engineering and operations research are closely related fields that deal with the design, analysis, and control of complex systems that include people, machines, material, and information, and the interactions of such systems with their environment. Formal models, often computer-based, are extensively used in systems analysis, while systems design, as in other fields of engineering, requires well-developed integrative skills and creativity. The theoretical foundations of optimization, stochastic systems, reliability, and engineering economics often form the basis for operations research studies. Industrial engineering frequently uses knowledge of production, human/machine systems, incentives, organizational behavior, and automation in the design and improvement of goal-seeking systems. These methods may be applied to a great variety of human activities in both public and private sectors, including manufacturing, banking, health care, communications, waste management, transportation, and logistics.

For more information, see the *College of Engineering Announcement: A Guide to Undergraduate and Graduate Study* (http://coe.berkeley.edu/students/college-of-engineering-announcement) online.

#### Undergraduate Program

Undergraduates in the Department of Industrial Engineering and Operations Research receive broad training in engineering fundamentals, principles of economics and advanced mathematics and statistics in order to prepare them for elective sequences which stress the construction of systems models, the role of the human being in these systems, and the related mathematical and computer methods of optimization and control. A unified core program is offered both for students who wish to pursue the professional aspects of the field, and for those who, after further education at the graduate level, wish to engage in teaching and research. In order to satisfy the needs of students with diverse objectives, considerable flexibility in planning individual programs is provided.

The BS program is accredited in industrial engineering and operations research by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD, 21202-4012; phone: (410) 347-7700.

Students interested in industrial engineering and operations research may also be interested in the operations research and management science major in the College of Letters and Science. See the "Operations Research and Management Science" section of this catalog for more information.

#### Curriculum and Requirements for the Bachelor's Degree

Students must complete a minimum of 120 units, in which they must satisfy the University of California and Berkeley campus requirements outlined in this bulletin. In addition, students must complete the requirements for the College of Engineering and the industrial engineering and operations research program. Full details on these requirements can be found in the *College of Engineering Announcement: A Guide to Undergraduate and Graduate Study* (http://coe.berkeley.edu/college-of-engineering-announcement) available online.

#### Graduate Programs

Graduate programs are offered leading to the MS or PhD.

The programs have been developed to meet the needs of individuals with backgrounds in engineering or the mathematical sciences who wish to enhance their knowledge of the theory, development, and use of quantitative models for the analysis, design, and organization of complex systems in the industrial, service, or public sectors. Students may concentrate on theoretical studies in preparation for doctoral-level research, or on applications of state-of-the-art techniques to real world problems.

Undergraduates from scientific disciplines other than engineering may be accepted into these programs. A master's degree may be earned by thesis or by comprehensive examination. Doctoral degrees require oral examination in the major and two minor fields followed by submission of a thesis demonstrating ability to conduct independent advanced research. Several computing laboratories, as well as a robotics laboratory, are available for graduate research.

The department requires all graduate applicants to submit scores of the general Graduate Record Examination (GRE). Further information on graduate programs may be obtained from the Industrial Engineering and Operations Research Office, 4141 Etcheverry Hall, Berkeley, CA 94720-1777, and in the *College of Engineering Announcement* (http://coe.berkeley.edu/college-of-engineering-announcement) .

Please visit this website (http://ieor.berkeley.edu/AcademicPrograms) for more information about the undergraduate and graduate programs.

**IND ENG 24 Freshman Seminars 1 Unit**
**Department:** Industrial Engin and Oper Research
**Course level:** Undergraduate
**Term course may be offered:** Fall
**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.

**IND ENG 115 Industrial and Commercial Data Systems 3 Units**
**Department:** Industrial Engin and Oper Research
**Course level:** Undergraduate
**Term course may be offered:** Fall
**Grading:** Letter grade.
**Hours and format:** 2 hours of lecture and 2 hours of laboratory/project per week.
**Prerequisites:** Upper division standing.
Design and implementation of databases, with an emphasis on industrial and commercial applications. Relational algebra, SQL, normalization. Students work in teams with local companies on a database design project. WWW design and queries.
Instructor: Goldberg

**IND ENG 130 Methods of Manufacturing Improvement 3 Units**
**Department:** Industrial Engin and Oper Research
**Course level:** Undergraduate
**Term course may be offered:** Spring
**Grading:** Letter grade.
**Hours and format:** 3 hours of Lecture per week for 15 weeks.
**Prerequisites:** 172, Mathematics 54, or Statistics 134 (may be taken concurrently).
Analytical techniques for the improvement of manufacturing performance along the dimensions of productivity, quality, customer service, and throughput. Techniques for yield analysis, process control, inspection sampling, equipment efficiency analysis, cycle time reduction, and on-time delivery improvement. Applications on semiconductor manufacturing or other industrial settings.
Instructor: Leachman

**IND ENG 131 Discrete Event Simulation 3 Units**
**Department:** Industrial Engin and Oper Research
**Course level:** Undergraduate
**Terms course may be offered:** Fall, spring and summer
**Grading:** Letter grade.
**Hours and format:** 2 hours of Lecture and 1 hour of Discussion per week for 15 weeks. 3 hours of Lecture and 1.5 hours of Discussion per week for 10 weeks. 4.5 hours of Lecture and 1.5 hours of Discussion per week for 8 weeks. 5 hours of Lecture and 1.5 hours of Discussion per week for 6 weeks.
**Prerequisites:** 161, 165; 172 or Statistics 134.
Introductory course on design, programming, and statistical analysis of a simulation study. Topics include the types of problems that can be solved by such methods. Programming material includes the theory behind random variable generation for a variety of common variables. Techniques to reduce the variance of the resultant estimator and statistical analysis are considered. Final project required.
Instructor: Schruben

**IND ENG 140 Introduction to Mobile Industrial Robots 4 Units**
**Department:** Industrial Engin and Oper Research
**Course level:** Undergraduate