Industrial Engineering and Operations Research

Bachelor of Science (BS)

The Bachelor of Science (BS) degree in Industrial Engineering and Operations Research (IEOR) is designed to prepare students for technical careers in production or service industries. It provides a strong foundation for those headed for engineering management positions or for those intending to go on to specialized graduate study in operations research, industrial engineering, or business administration.

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 & Science. For further information on this program, please see the Operations Research and Management Science page (http://guide.berkeley.edu/archive/2016-17/undergraduate/degree-programs/operations-research-management-science) in this Guide.

Course of Study Overview

The core of the program includes basic science, mathematics including probability and statistics, engineering optimization, and stochastic models. This forms the methodological foundation for upper division IEOR electives involving the analysis and design of production and service systems, information systems, and human work systems and organization, among others.

Accreditation

This program is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org) .

Admission to the Major

Prospective undergraduates to the College of Engineering will apply for admission to a specific program in the College. For further information, please see the College of Engineering's website (http://coe.berkeley.edu/students/prospective-students/admissions.html) .

Admission to Engineering via a Change of College application for current UC Berkeley students is highly unlikely and very competitive as there are few, if any, spaces that open in the College each year to students admitted to other colleges at UC Berkeley. For further information regarding a change of college to Engineering, please see the College's website (http://coe.berkeley.edu/students/current-undergraduates/change-of-college) .

Minor Program

The department offers a minor in IEOR. Students must have a minimum overall grade point average (GPA) of 3.0 and a minimum GPA of 3.0 in the minor's prerequisite courses in order to be considered for departmental acceptance into the minor.

For the minor to be added to the transcript, students must file the Confirmation of Completion of Minor form with the Office of Undergraduate Advising in 4145 Etcheverry Hall during the last semester in which they complete their last class for the minor.

In addition to the University, campus, and college requirements, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All technical courses (courses in engineering, mathematics, chemistry, physics, statistics, biological sciences, and computer science) must be taken for a letter grade.
2. No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
3. A minimum overall grade point average (GPA) of 2.0 is required for all work undertaken at UC Berkeley.
4. A minimum GPA of 2.0 is required for all technical courses taken in satisfaction of major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

For a detailed plan of study by year and semester, please see the Plan of Study tab.

Lower Division Requirements

MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory [1]	4
or CHEM 4A	General Chemistry and Quantitative Analysis	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
Programming: Select one of the following:		2-4
COMPSCI 9C	C for Programmers	
COMPSCI 9F	C++ for Programmers	
COMPSCI 9G	JAVA for Programmers [2]	
COMPSCI 61A	The Structure and Interpretation of Computer Programs	
Engineering Breadth Electives: Select at least 9 units from the following:		9
BIO ENG 10	Introduction to Biomedicine for Engineers	
BIO ENG 102	Biomechanics: Analysis and Design	
CIV ENG 11	Engineered Systems and Sustainability	
CIV ENG C30/ MEC ENG C85	Introduction to Solid Mechanics	
CIV ENG 60	Structure and Properties of Civil Engineering Materials	
CIV ENG 70	Engineering Geology	
CIV ENG 155	Transportation Systems Engineering	
DES INV 15	Design Methodology [3]	
EL ENG 16A	Designing Information Devices and Systems I	
EL ENG 16B	Designing Information Devices and Systems II	
ENGIN 15	Design Methodology [3]	

ENGIN 25	Visualization for Design	
ENGIN 26	Three-Dimensional Modeling for Design	
ENGIN 27	Introduction to Manufacturing and Tolerancing	
ENGIN 45	Properties of Materials	
ENGIN 45L	Properties of Materials Laboratory	
ENGIN 115	Engineering Thermodynamics	
MAT SCI 111	Properties of Electronic Materials	
MEC ENG 40	Thermodynamics	
MEC ENG 132	Dynamic Systems and Feedback	

1 CHEM 4A is intended for students majoring in chemistry or a closely-related field.

2 COMPSCI 9C is a prerequisite for COMPSCI 9G.

3 Students will not receive credit for both DES INV 15 and ENGIN 15.

Upper Division Requirements

ENGIN 120	Principles of Engineering Economics [1]	3
or IND ENG 120	Principles of Engineering Economics	
IND ENG 131	Discrete Event Simulation	3
IND ENG 160	Nonlinear and Discrete Optimization	3
IND ENG 162	Linear Programming and Network Flows	3
IND ENG 165	Engineering Statistics, Quality Control, and Forcasting	3
IND ENG 172	Probability and Risk Analysis for Engineers [2]	3
or STAT 134	Concepts of Probability	
IND ENG 173	Introduction to Stochastic Processes [3]	3
IND ENG 180	Senior Project	4
IND ENG Electives: Select 6 courses from the following:		18
IND ENG 115	Industrial and Commercial Data Systems	
IND ENG 130	Methods of Manufacturing Improvement	
IND ENG 150	Production Systems Analysis	
IND ENG 151	Service Operations Design and Analysis	
IND ENG 153	Logistics Network Design and Supply Chain Management	
IND ENG 166	Decision Analytics	
IND ENG 170	Industrial Design and Human Factors	
IND ENG 171	Technology Firm Leadership	

1 Students will not receive credit for both IND ENG 120 and ENGIN 120.

2 IND ENG 172 is an alternative course for STAT 134. In semesters when both are offered, we recommend students take IND ENG 172. Students will not receive credit for both STAT 134 and IND ENG 172.

3 IND ENG 173 replaced IND ENG 161. Students will receive no credit for IND ENG 173 after taking IND ENG 161.

Minor programs are areas of concentration requiring fewer courses than an undergraduate major. These programs are optional but can provide depth and breadth to a UC Berkeley education. The College of Engineering does not offer additional time to complete a minor, but it is usually possible to finish within the allotted time with careful course planning. Students are encouraged to meet with their ESS adviser to discuss the feasibility of completing a minor program.

All the engineering departments offer minors. Students may also consider pursuing a minor in another school or college.

General Guidelines

1. All courses taken to fulfill the minor requirements must be taken for graded credit.
2. A minimum overall grade point average (GPA) of 3.0 and a minimum GPA of 3.0 in the prerequisite courses is required for acceptance into the minor program.
3. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
4. No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
5. Completion of the minor program cannot delay a student's graduation.

Requirements

Prerequisites		
IND ENG 165	Engineering Statistics, Quality Control, and Forcasting	3
or STAT 135	Concepts of Statistics	
IND ENG 172	Probability and Risk Analysis for Engineers	3
or STAT 134	Concepts of Probability	
IND ENG 160	Nonlinear and Discrete Optimization	3
or IND ENG 162	Linear Programming and Network Flows	
Upper Division Requirements		
IND ENG 160	Nonlinear and Discrete Optimization	3
or IND ENG 162	Linear Programming and Network Flows	
IND ENG 131	Discrete Event Simulation	3
or IND ENG 173	Introduction to Stochastic Processes	
or IND ENG 166	Decision Analytics	
Select two from the following:		
IND ENG 115	Industrial and Commercial Data Systems	
IND ENG 130	Methods of Manufacturing Improvement	
IND ENG 150	Production Systems Analysis	
IND ENG 151	Service Operations Design and Analysis	
IND ENG 153	Logistics Network Design and Supply Chain Management	
IND ENG 170	Industrial Design and Human Factors	
IND ENG 171	Technology Firm Leadership	

Students in the College of Engineering must complete no fewer than 120 semester units with the following provisions:

1. Completion of the requirements of one engineering major program (http://coe.berkeley.edu/students/guide/departments) of study.
2. A minimum overall grade point average of 2.00 (C average) and a minimum 2.00 grade point average in upper division technical coursework required of the major.
3. The final 30 units and two semesters must be completed in residence in the College of Engineering on the Berkeley campus.
4. All technical courses (math, science and engineering), required of the major or not, must be taken on a letter graded basis (unless they are only offered P/NP).

5. Entering freshmen are allowed a maximum of eight semesters to complete their degree requirements. Entering junior transfers are allowed a maximum of four semesters to complete their degree requirements. (Note: junior transfers admitted missing three or more courses from the lower division curriculum are allowed five semesters.) Summer terms are optional and do not count toward the maximum. Students are responsible for planning and satisfactorily completing all graduation requirements within the maximum allowable semesters.
6. Adhere to all college policies and procedures (http://engineering.berkeley.edu/academics/undergraduate-guide) as they complete degree requirements.
7. Complete the lower division program before enrolling in upper division engineering courses.

Humanities and Social Science (H/SS) Requirement

To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a six-course Humanities and Social Sciences breadth requirement (http://engineering.berkeley.edu/student-services/degree-requirements/humanities-and-social-sciences) , which must be completed to graduate. This requirement, built into all the engineering programs of study, includes two reading and composition courses (R&C), and four additional courses within which a number of specific conditions must be satisfied. Follow these guidelines to fulfill this requirement:

1. Complete a minimum of six courses from the approved Humanities/Social Sciences (H/SS) lists (http://coe.berkeley.edu/hssreq) .
2. Courses must be a minimum of 3 semester units (or 4 quarter units).
3. Two of the six courses must fulfill the college's Reading and Composition (R&C) requirement. These courses must be taken for a letter grade (C- or better required) and must be completed by no later than the end of the sophomore year (fourth semester of enrollment). The first half of R&C, the “A” course, must be completed by the end of the freshman year; the second half of R&C, the “B" course, must be completed by no later than the end of the sophomore year. View a detailed lists of courses (http://ls-advise.berkeley.edu/requirement/rccourses.html) that fulfill Reading and Composition requirements, or use the College of Letters and Sciences search engine (http://ls-breadth.berkeley.edu) to view R&C courses offered in a given semester.
4. The four additional courses must be chosen within College of Engineering guidelines from the H/SS lists (see below). These courses may be taken on a Pass/Not Passed basis (P/NP).
5. Two of the six courses must be upper division (courses numbered 100-196).
6. One of the six courses must satisfy the campus American Cultures requirement. For detailed lists of courses that fulfill American Cultures requirements, visit the American Cultures (http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/engineering/american-cultures-requirement) site.
7. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. View the list of exams (http://engineering.berkeley.edu/academics/undergraduate-guide/exams-ap-ib-level-and-transfer-credit-information) that can be applied toward H/SS requirements.
8. Courses may fulfill multiple categories. For example, if you complete CY PLAN 118AC (http://guide.berkeley.edu/search/?P=CY%20PLAN%20118AC) that would satisfy the American Cultures requirement and one upper division H/SS requirement.
9. No courses offered by any engineering department other than BIO ENG 100 (http://guide.berkeley.edu/search/?P=BIO%20ENG%20100), COMPSCI C79 (http://guide.berkeley.edu/search/?P=COMPSCI%20C79), ENGIN 125 (http://guide.berkeley.edu/search/?P=ENGIN%20125), ENGIN 157AC (http://guide.berkeley.edu/search/?P=ENGIN%20157AC), MEC ENG 191K (http://guide.berkeley.edu/search/?P=MEC%20ENG%20191K) and MEC ENG 191AC (http://guide.berkeley.edu/search/?P=MEC%20ENG%20191AC) may be used to complete H/SS requirements.
10. Foreign language courses may be used to complete H/SS requirements. View the list of language options (http://ls-advise.berkeley.edu/requirement/fl.html) .
11. Courses numbered 97, 98, 99, or above 196 may not be used to complete any H/SS requirement
12. The College of Engineering uses modified versions of five of the College of Letters and Science (L&S) breadth requirements lists to provide options to our students for completing the H/SS requirement. No courses on the L&S Biological Sciences or Physical Sciences breadth lists may be used to complete H/SS requirements. Within the guidelines above, choose courses from any of the lists below.

    - Arts and Literature (http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-arts-literature)
    - Foreign Language (http://ls-advise.berkeley.edu/requirement/fl.html)
    - Historical Studies (http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-historical-studies)
    - International Studies (http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-international-studies)
    - Philosophy and Values (http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-philosophy-values)
    - Social and Behavioral Studies (http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-social-behavioral-sciences)

Class Schedule Requirements

- Minimum units per semester: 12.0.
- Maximum units per semester: 20.5.
- Minimum technical courses: College of Engineering undergraduates must enroll each semester in no fewer than two technical courses (of a minimum of 3 units each) required of the major program of study in which the student is officially declared. (Note: for most majors, normal progress will require enrolling in 3-4 technical courses each semester).
- All technical courses (math, science, engineering), required of the major or not, must be taken on a letter graded basis (unless only offered as P/NP).
- A student's proposed schedule must be approved by a faculty adviser (or on approval from the dean or a designated staff adviser) each semester prior to enrolling in courses.

Minimum Academic (Grade) Requirements

- A minimum overall and semester grade point average of 2.00 (C average) is required of engineering undergraduates. A student will be subject to dismissal from the University if during any fall or spring semester their overall UC GPA falls below a 2.00, or their semester GPA is less than 2.00.
- Students must achieve a minimum grade point average of 2.00 (C average) in upper division technical courses required of the major curriculum each semester. A student will be subject to dismissal from the University if their upper division technical grade point average falls below 2.00.
- A minimum overall grade point average of 2.00, and a minimum 2.00 grade point average in upper division technical course work required of the major is needed to earn a Bachelor of Science in Engineering.

Unit Requirements

To earn a Bachelor of Science in Engineering, students must complete at least 120 semester units of courses subject to certain guidelines:

- Completion of the requirements of one engineering major program (http://coe.berkeley.edu/students/guide/departments) of study.
- A maximum of 16 units of special studies coursework (courses numbered 97, 98, 99, 197, 198, or 199) is allowed towards the 120 units; a maximum of four is allowed in a given semester.
- A maximum of 4 units of physical education from any school attended will count towards the 120 units.
- Students may receive unit credit for courses graded P (including P/NP units taken through EAP) up to a limit of one-third of the total units taken and passed on the Berkeley campus at the time of graduation.

Normal Progress

Students in the College of Engineering must enroll in a full-time program and make normal progress each semester toward the bachelor's degree. The continued enrollment of students who fail to achieve minimum academic progress shall be subject to the approval of the dean. (Note: students with official accommodations established by the Disabled Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

For more detailed information regarding the courses listed below (e.g., elective information, GPA requirements, etc.,), please see the College Requirements and Major Requirements tabs.

				Freshman
	Fall	**Units**	**Spring**	**Units**
CHEM 4A or 1A ***and*** 1AL		4	MATH 1B	4
MATH 1A		4	PHYSICS 7A	4
Reading and Composition course from List A		4	ENGIN 7	4
Engineering Breadth course[2]		3	Reading & Composition course from List B	4
Optional Freshman Seminar or ENGIN 92		0-1		
		15-16		**16**

				Sophomore
	Fall	**Units**	**Spring**	**Units**
MATH 53		4	MATH 54	4
PHYSICS 7B		4	ENGIN 120 or IND ENG 120	3
Engineering Breadth course[2]		3	Programming course[3]	2-4
Humanities/Social Sciences course		3-4	Engineering Breadth course[2]	3
			Humanities/ Social Sciences course	3-4
		14-15		**15-18**

				Junior
	Fall	**Units**	**Spring**	**Units**
IND ENG 160		3	IND ENG 165	3
IND ENG 162		3	IND ENG 173[5]	3
IND ENG 172 or STAT 134[4]		3	IND ENG Electives[6]	6
IND ENG Elective[6]		3	Humanities/ Social Sciences course	3-4
Humanities/Social Sciences course		3-4		
		15-16		**15-16**

				Senior
	Fall	**Units**	**Spring**	**Units**
IND ENG Electives[6]		6	IND ENG 131	3
Free Electives		9	IND ENG 180	4
			IND ENG Elective[6]	3
			Free Electives	5
		15		**15**

Total Units: 120-127

1. CHEM 4A is intended for students majoring in chemistry or a closely-related field.
2. Engineering Breadth: 9 units must be completed from the following list: BIO ENG 10, BIO ENG 102, CIV ENG 11, CIV ENG C30, CIV ENG 60, CIV ENG 70, CIV ENG 155, DES INV 15, EL ENG 16A, EL ENG 16B, ENGIN 15, ENGIN 25, ENGIN 26, ENGIN 27, ENGIN 45, ENGIN 45L, ENGIN 115, MAT SCI 111, MEC ENG 40, MEC ENG C85, MEC ENG 132. Students will not receive credit for both DES INV 15 and ENGIN 15.
3. A course in computer programming must be completed. Choose one course from: COMPSCI 9C, COMPSCI 9F, COMPSCI 9G, or COMPSCI 61A. COMPSCI 9C is a prerequisite for COMPSCI 9G.
4. IND ENG 172 is an alternative course for STAT 134. In semesters when both are offered, we recommend students take IND ENG 172. Students will not receive credit for both STAT 134 and IND ENG 172.
5. IND ENG 173 replaced IND ENG 161. Students will receive no credit for IND ENG 173 after taking IND ENG 161.
6. Students must take a minimum of six courses from the following: IND ENG 115, IND ENG 130, IND ENG 150, IND ENG 151, IND ENG

Learning Goals for the Major

The IEOR Department has five general objectives for its Bachelor of Science (BS) degree program. It aims for BS degree graduates to become highly skilled in:

1. Quantitative modeling and analysis of a broad array of systems-level decision problems concerned with economic efficiency, productivity, and quality.

2. Development and creative use of analytical and computational methods for solving these problems.
3. Collection of and analysis of data, and the use of database and decision-support tools.
4. Comprehension and analysis of uncertainty.
5. In addition, the department expects their graduates to obtain the broader skills, background, and knowledge necessary to be an effective professional in a rapidly changing global economy.

All Berkeley engineering graduates acquire the following skills and knowledge:

1. Ability to apply knowledge of mathematics, science, and engineering.
2. Ability to design and conduct experiments, analyze, and interpret data.
3. Ability to design a system, component, or process to meet desired needs.
4. Ability to function on multi-disciplinary teams.
5. Ability to identify, formulate, and solve engineering problems.
6. Understanding of professional and ethical responsibility.
7. Ability to communicate effectively.
8. Understand impact of engineering solutions in a global and societal context.
9. Recognition of need for and ability to engage in life-long learning.
10. Knowledge of contemporary issues.
11. Ability to use techniques, skills, and modern engineering tools for engineering practice.

More specific outcomes of the IEOR BS degree program are as follows:

1. Identify, analyze, and evaluate alternative or candidate solutions for decision problems.
2. Identify appropriate models and methods for solving decision problems.
3. Formulate mathematical optimization models for real-life decision problems.
4. Understand methods for solving deterministic optimization problems and utilize optimization software for solving such problems.
5. Formulate analytical models and develop computer simulations to predict and optimize systems under uncertainty.
6. Develop models and utilize analytical tools and software to evaluate decisions under uncertainty.
7. Understand performance measurement.
8. Understand important concepts in manufacturing and service operations.
9. Design and apply analytical models for manufacturing and service operations.
10. Critique and reorganize business and industrial process flows and information flows.
11. Structure data to support decisions related to the aforementioned topics.
12. Understand organizational design and management issues.

Advising Values

Student Success: Above all, the department is dedicated to maximizing student potential and to helping students succeed in their University experiences. The department encourages students to explore their minds and their hearts, challenges them to do their best work, and helps them realize their talents and passions and achieve their goals.

Equity & Inclusion: The department is committed to creating an inclusive environment in which any individual or group can be and feel welcomed, respected, supported and valued. It aspires to provide fair treatment, access, opportunity, and advancement for all students and to identify and eliminate barriers that prevent the full participation of all.

Health & Well-Being: The department collaborates with campus partners to keep the IEOR community healthy by helping students balance the physical, intellectual, emotional, social, occupational, spiritual, and environmental aspects of life.

Advising Excellence: In all that it does, the department strives to deliver personalized advising services of the highest quality. It seeks to continuously educate itself on developments in the field and to evaluate, improve, and streamline its services to support students in obtaining the best education and experience possible.

Advising Staff and Advising Hours

Academic Advising
College of Engineering Undergraduate Adviser
Jane Paris
jparis@berkeley.edu (anayancy@berkeley.edu)
230 Bechtel Engineering Center
510-642-7594

Department Student Services
Anayancy Paz
anayancy@berkeley.edu
4145 Etcheverry Hall
510-642-5485

IEOR Department Student Services Office hours: fall, spring, and summer: Monday through Wednesday and Friday: 9 to noon and 1 to 4 p.m.; and Thursdays 1 to 4 p.m.

Student Groups and Organizations

The Industrial Engineering and Operations Research (IEOR) Department is very proud that its students not only excel in academics but also in social organization. The department hosts three professional student organizations that engage in activities such as advising, recruiting and graduate schools information, alumni relations, academic conference organization, and social events. For information regarding student groups, please see the following websites:

IEOR Alumni (http://ieor.berkeley.edu/alumni)
Alpha Pi Mu (http://apm.ieor.berkeley.edu) (Industrial Engineering Honor Society)
IIE Student Chapter (http://iie.berkeley.edu) (Institute of Industrial Engineers)
INFORMS Student Chapter (http://www.ieor.berkeley.edu/~informs) (Institute for Operations Research and Management Science)

Study Abroad

The College of Engineering encourages all undergraduates in the college to study abroad. Whether students are interested in fulfilling general education requirements, taking courses related to their major/career, or simply living and studying in a country that is of interest to them, the department will work with students to make it happen. For information

about study abroad programs, please see the Berkeley Study Abroad website (http://studyabroad.berkeley.edu) .

Career Services

The Career Center offers personalized career counseling and a wide variety of professional development workshops on topics such as networking as a job search strategy, getting results from the internet job search, internship search and success strategies, and applying for graduate school. For further information, please see the Career Services website (https://career.berkeley.edu) .

Industrial Engineering and Operations Research

IND ENG 24 Freshman Seminars 1 Unit

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Freshman Seminars: Read More [+]
Objectives Outcomes

Course Objectives: Provide an introduction to the field of Industrial Engineering and Operations Research through a series of lectures.

Student Learning Outcomes: Learn more about Industrial Engineering and Operations Research.

Rules & Requirements

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

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman Seminars: Read Less [-]

IND ENG 66 A Bivariate Introduction to IE and OR 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2016
This Freshman-level Introductory course will provide an intuitive overview of the fundamental problems addressed and methods in the fields of Industrial Engineering and Operations Research including Constrained Optimization, Human Factors, Data Analytics, Queues and Chains, and Linear Programming. The course will focus on two-dimensional, i.e., bivariate, examples where the problems and methods are amenable to visualization and geometric intuition. The course will discuss applications such as dieting, scheduling, and transportation. This course will not require pre-requisites and will present the core concepts in a self-contained manner that is accessible to Freshmen to provide the foundation for future coursework.
A Bivariate Introduction to IE and OR: Read More [+]
Objectives Outcomes

Course Objectives: • Provide a broad survey of the important topics in IE and OR, and develop intuition about problems, algorithms, and abstractions using bivariate examples (2D).
• Describe different mathematical abstractions used in IEOR (e.g., graphs, queues, Markov chains), and how to use these abstractions to model real-world problems.
• Introduce students to the data analysis process including: developing a hypothesis, acquiring data, processing the data, testing the hypothesis, and presenting results.
• Provide students with concrete examples of how the mathematical tools from the class apply to real problems such as dieting, scheduling, and transportation.

Rules & Requirements

Credit Restrictions: Course restricted to Freshman students.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Goldberg

A Bivariate Introduction to IE and OR: Read Less [-]

IND ENG 95 A. Richard Newton Lecture Series 1 Unit

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
This lecture series serves as an entry point for undergraduate and graduate curriculum sequences in entrepreneurship and innovation. The series, established in 2005, is named in honor of A. Richard Newton, a visionary technology industry leader and late dean of the University of California Berkeley College of Engineering. The course features a selection of high-level industry speakers who share their insights on industry developments, leadership, and innovation based on their careers.
A. Richard Newton Lecture Series: Read More [+]
Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of colloquium per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Alternative to final exam.

Instructor: Sidhu

A. Richard Newton Lecture Series: Read Less [-]

IND ENG 98 Supervised Group Study and Research 1 - 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2015, Spring 2015
Supervised group study and research by lower division students.
Supervised Group Study and Research: Read More [+]
Rules & Requirements

Prerequisites: Consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of directed group study per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Group Study and Research: Read Less [-]

IND ENG 99 Supervised Independent Study and Research 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Prior to 2007
Supervised independent study for lower division students.
Supervised Independent Study and Research: Read More [+]
Rules & Requirements

Prerequisites: Freshman or sophomore standing and consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:
8 weeks - 1.5-7.5 hours of independent study per week
10 weeks - 1.5-6 hours of independent study per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study and Research: Read Less [-]

IND ENG 115 Industrial and Commercial Data Systems 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Industrial and Commercial Data Systems: Read More [+]
Rules & Requirements

Prerequisites: Upper division standing

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Goldberg

Industrial and Commercial Data Systems: Read Less [-]

IND ENG 120 Principles of Engineering Economics 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Prior to 2007
Economic analysis for engineering decision making: Capital flows, effect of time and interest rate. Different methods of evaluation of alternatives. Minimum-cost life and replacement analysis. Depreciation and taxes. Uncertainty; preference under risk; decision analysis. Capital sources and their effects. Economic studies. Formerly Engineering 120.
Principles of Engineering Economics: Read More [+]
Rules & Requirements

Credit Restrictions: Students will receive 2 units for 120 after taking Civil Engineering 167. Students will not receive credit after taking Engineering 120.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 4 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Adler

Principles of Engineering Economics: Read Less [-]

IND ENG 130 Methods of Manufacturing Improvement 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Fall 2016, Fall 2015
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.
Methods of Manufacturing Improvement: Read More [+]
Rules & Requirements

Prerequisites: 172, Mathematics 54, or Statistics 134 (may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Leachman

Methods of Manufacturing Improvement: Read Less [-]

IND ENG 131 Discrete Event Simulation 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Spring 2017, Spring 2016
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.
Discrete Event Simulation: Read More [+]
Rules & Requirements

Prerequisites: 161, 165; 172 or Statistics 134

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Summer:
6 weeks - 5 hours of lecture and 1.5 hours of discussion per week
8 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week
10 weeks - 3 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Schruben

Discrete Event Simulation: Read Less [-]

IND ENG 135 Applied Data Science with Venture Applications 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017
This highly-applied course surveys a variety of key of concepts and tools that are useful for designing and building applications that process data signals of information. The course introduces modern open source, computer programming tools, libraries, and code samples that can be used to implement data applications. The mathematical concepts highlighted in this course include filtering, prediction, classification, decision-making, Markov chains, LTI systems, spectral analysis, and frameworks for learning from data. Each math concept is linked to implementation using Python using libraries for math array functions (NumPy), manipulation of tables (Pandas), long term storage (SQL, JSON, CSV files), natural language (NLTK), and ML frameworks.
Applied Data Science with Venture Applications: Read More [+]
Objectives Outcomes

Student Learning Outcomes: Students will be able to design and build data sample application systems that can interpret and use data for a wide range of real life applications across many disciplines and industries;
implement these concepts within applications with modern open source CS tools.
understand relevant mathematical concepts that are used in systems that process data;

Rules & Requirements

Prerequisites: Prerequisites include the ability to write code in Python, and a probability or statistics course. This course is ideal for students who have taken CS/INFO/STAT C8

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: Sidhu

Applied Data Science with Venture Applications: Read Less [-]

IND ENG 142 Introduction to Machine Learning and Data Analytics 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017
This course introduces students to key techniques in machine learning and data analytics through a diverse set of examples using real datasets from domains such as e-commerce, healthcare, social media, sports, the Internet, and more. Through these examples, exercises in R, and a comprehensive team project, students will gain experience understanding and applying techniques such as linear regression, logistic regression, classification and regression trees, random forests, boosting, text mining, data cleaning and manipulation, data visualization, network analysis, time series modeling, clustering, principal component analysis, regularization, and large-scale learning.
Introduction to Machine Learning and Data Analytics: Read More [+]
Objectives Outcomes

Course Objectives: 1. To expose students to a variety of statistical learning methods, all of which are relevant in useful in wide range of disciplines and applications.
2. To carefully present the statistical and computational assumptions, trade-offs, and intuition underlying each method discussed so that students will be trained to determine which techniques are most appropriate for a given problem.
3. Through a series of real-world examples, students will learn to identify opportunities to leverage the capabilities of data analytics and will see how data analytics can provide a competitive edge for companies.
4. To train students in how to actually apply each method that is discussed in class, through a series of labs and programming exercises.
5. For students to gain some project-based practical data science experience, which involves identifying a relevant problem to be solved or question to be answered, gathering and cleaning data, and applying analytical techniques.
6. To introduce students to advanced topics that are important to the successful application of machine learning methods in practice, include how methods for prediction are integrated with optimization models and modern optimization techniques for large-scale learning problems.

Rules & Requirements

Prerequisites: IEOR 165 or equivalent course in statistics. Prior exposure to optimization is helpful but not strictly necessary. Some programming experience/literacy is expected

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructors: Grigas, Paul

Introduction to Machine Learning and Data Analytics: Read Less [-]

IND ENG 150 Production Systems Analysis 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2016, Fall 2015
Quantitative models for operational and tactical decision making in production systems, including production planning, inventory control, forecasting, and scheduling.
Production Systems Analysis: Read More [+]
Rules & Requirements

Prerequisites: 160, 161, 162, 165, and Engineering 120, or senior standing in manufacturing engineering

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Yano

Production Systems Analysis: Read Less [-]

IND ENG 151 Service Operations Design and Analysis 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Fall 2016, Fall 2015
This course is concerned with improving processes and designing facilities for service businesses such as banks, health care organizations, telephone call centers, restaurants, and transportation providers. Major topics in the course include design of service processes, layout and location of service facilities, demand forecasting, demand management, employee scheduling, service quality management, and capacity planning.
Service Operations Design and Analysis: Read More [+]
Rules & Requirements

Prerequisites: 161, 162, and a course in statistics

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Service Operations Design and Analysis: Read Less [-]

IND ENG 153 Logistics Network Design and Supply Chain Management 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Spring 2017, Spring 2016
We will focus primarily on both quantitative and qualitative issues which arise in the integrated design and management of the entire logistics network. Models and solution techniques for facility location and logistics network design will be considered. In addition, qualitative issues in distribution network structuring, centralized versus decentralized network control, variability in the supply chain, strategic partnerships, and product design for logistics will be considered through discussions and cases.
Logistics Network Design and Supply Chain Management: Read More [+]
Rules & Requirements

Prerequisites: 160, 162 or senior standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Kaminsky

Logistics Network Design and Supply Chain Management: Read Less [-]

IND ENG 160 Nonlinear and Discrete Optimization 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Spring 2017, Fall 2016
This course introduces unconstrained and constrained optimization with continuous and discrete domains. Convex sets and convex functions; local optimality; KKT conditions; Lagrangian duality; steepest descent and Newton's method. Modeling with integer variables; branch-and-bound method; cutting planes. Models on production/inventory planning, logistics, portfolio optimization, factor modeling, classification with support vector machines.
Nonlinear and Discrete Optimization: Read More [+]
Rules & Requirements

Prerequisites: Mathematics 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Atamturk

Nonlinear and Discrete Optimization: Read Less [-]

IND ENG 162 Linear Programming and Network Flows 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
This course addresses modeling and algorithms for optimization of linear constrained optimization problems. The simplex method; theorems of duality; complementary slackness. Applications in production planning and resource allocation. Graph and network problems as linear programs with integer solutions. Algorithms for selected network flow problems. Transportation and logistics problems. Dynamic programming and its role in applications to shortest paths, project management and equipment replacement.
Linear Programming and Network Flows: Read More [+]

Rules & Requirements

Prerequisites: Mathematics 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Hochbaum

Linear Programming and Network Flows: Read Less [-]

IND ENG S162 Linear Programming 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Prior to 2007
Formulation to linear programs. Optimal allocation and control problems in industry, environmental studies. Convex sets; properties of optimal solutions. The simplex method; theorems of duality; complementary slackness. Problems of post-optimization. Special structures; network problems. Digital computation.
Linear Programming: Read More [+]

Rules & Requirements

Prerequisites: Mathematics 50A

Hours & Format

Summer: 8 weeks - 4 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Linear Programming: Read Less [-]

IND ENG 164 Introduction to Optimization Modeling 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Not yet offered
Designed for students from any science/engineering major, this upper-division course will introduce students to optimization models, and train them to use software tools to model and solve optimization problems. The main goal is to develop proficiency in common optimization modeling languages, and learn how to integrate them with underlying optimization solvers. Students will work primarily on modeling exercises, which will develop confidence in modeling and solve optimization methods using software packages, and will require some programming.
Review of linear and nonlinear optimization models, including optimization problems with discrete decision variables. Applications to practical problems from engineering and data science.
Introduction to Optimization Modeling: Read More [+]

Objectives Outcomes

Course Objectives: • To introduce students to the core concepts of optimization

• To train them in the art and science of using software tools to model and solve optimization problems.

Rules & Requirements

Prerequisites: No pre-requisites except some Python programming skills, which can be met by CS 8 (or any other Python-based course)

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introduction to Optimization Modeling: Read Less [-]

IND ENG 165 Engineering Statistics, Quality Control, and Forcasting 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Spring 2017, Spring 2016
This course will introduce students to basic statistical techniques such as parameter estimation, hypothesis testing, regression analysis, analysis of variance. Applications in forecasting and quality control.
Engineering Statistics, Quality Control, and Forcasting: Read More [+]

Rules & Requirements

Prerequisites: Industrial Engineering 172 or Statistics 134 or an equivalent course in probability theory

Credit Restrictions: Students will receive no credit for Industrial Engineering 165 after taking Statistics 135.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 6 weeks - 7.5 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Engineering Statistics, Quality Control, and Forcasting: Read Less [-]

IND ENG 166 Decision Analytics 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Spring 2017, Spring 2016
Introductory course on the theory and applications of decision analysis. Elective course that provides a systematic evaluation of decision-making problems under uncertainty. Emphasis on the formulation, analysis, and use of decision-making techniques in engineering, operations research and systems analysis. Includes formulation of risk problems and probabilistic risk assessments. Graphical methods and computer software using event trees, decision trees, and influence diagrams that focus on model design.
Decision Analytics: Read More [+]

Rules & Requirements

Prerequisites: 172 or Statistics 134

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Oren

Decision Analytics: Read Less [-]

IND ENG 170 Industrial Design and Human Factors 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Spring 2017, Spring 2016
This course surveys topics related to the design of products and interfaces ranging from alarm clocks, cell phones, and dashboards to logos, presentations, and web sites. Design of such systems requires familiarity with human factors and ergonomics, including the physics and perception of color, sound, and touch, as well as familiarity with case studies and contemporary practices in interface design and usability testing. Students will solve a series of design problems individually and in teams.
Industrial Design and Human Factors: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Goldberg

Industrial Design and Human Factors: Read Less [-]

IND ENG 171 Technology Firm Leadership 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
This course explores key management and leadership concepts relevant to the high-technology world. Topics include the firm's key operations, strategic issues, and managerial leadership including personal leadership and talent management. This course prepares technical and business minded students for careers focused on professional and management track careers in high technology. Students undertake intensive study of actual business situations through rigorous case-study analysis.
Technology Firm Leadership: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing

Credit Restrictions: Students will receive no credit for 171 after taking Undergraduate Business Administration 105.

Repeat rules: Students cannot receive credit for both 171 and Business Administration 105.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Technology Firm Leadership: Read Less [-]

IND ENG 172 Probability and Risk Analysis for Engineers 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Fall 2016, Fall 2015
This is an introductory course in probability designed to develop a good understanding of uncertain phenomena and the mathematical tools used to model and analyze it. Applications will be given in such areas as reliability theory, risk theory, inventory theory, financial models, and computer science, among others. To complement the theory, the course also covers the basics of stochastic simulation. This course is a probability course and cannot be used to fulfill any engineering unit or elective requirements.
Probability and Risk Analysis for Engineers: Read More [+]

Objectives Outcomes

Course Objectives: Students will learn how to model random phenomena and learn about a variety of areas where it is important to estimate the likelihood of uncertain events. Students will also learn how to use computer simulation to replicate and analyze these events.

Rules & Requirements

Prerequisites: Students should have a solid knowledge of calculus, including multiple variable integration, such as Mathematics 1A-1B or 16A-16B, as well as programming experience in Matlab or Python

Credit Restrictions: Students will receive no credit for 172 after taking Statistics 134 or Stat 140.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 6 weeks - 5 hours of lecture and 2.5 hours of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Probability and Risk Analysis for Engineers: Read Less [-]

IND ENG 173 Introduction to Stochastic Processes 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Spring 2017
This is an introductory course in stochastic models. It builds upon a basic course in probability theory and extends the concept of a single random variable into collections of random variables known as stochastic processes. The course focuses on discrete-time Markov chains, Poisson process, continuous-time Markov chains, and renewal theory. It also discusses applications to queueing theory, risk analysis and reliability theory. Along with the theory, the course covers stochastic simulation techniques that will allow students to go beyond the models and applications discussed in the course.
Introduction to Stochastic Processes: Read More [+]
Objectives Outcomes

Course Objectives: Students will learn how to model random phenomena that evolves over time, as well as the simulation techniques that enable the replication of such problems using a computer. By discussing various applications in science and engineering, students will be able to model many real world problems where uncertainty plays an important role.

Rules & Requirements

Prerequisites: Students should have taken a probability course, such as STAT 134 or IND ENG 172, and should have programming experience in Matlab or Python

Credit Restrictions: Students will receive no credit for Ind Eng 173 after taking Ind Eng 161.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introduction to Stochastic Processes: Read Less [-]

IND ENG 180 Senior Project 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
Application of systems analysis and industrial engineering to the analysis, planning, and/or design of industrial, service, and government systems. Consideration of technical and economic aspects of equipment and process design. Students work in teams under faculty supervision. Topics vary yearly.
Senior Project: Read More [+]
Rules & Requirements

Prerequisites: 131, 160, 161, 162, 165, Engineering 120, and three other Industrial Engineering and Operations Research electives

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture, 1 hour of discussion, and 6 hours of fieldwork per week

Summer: 10 weeks - 1.5 hours of lecture, 1.5 hours of discussion, and 9 hours of fieldwork per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Senior Project: Read Less [-]

IND ENG 185 Challenge Lab 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Summer 2017 Second 6 Week Session
This course is meant for students in engineering and other disciplines who seek a challenging, interactive, team-based, and hands-on learning experience in entrepreneurship and technology. In this highly experiential course, students work in simulated start-up teams to create products or start-up ideas to address a broadly-defined need of an industry partner or social challenge.
Challenge Lab: Read More [+]
Objectives Outcomes

Course Objectives: 1) To catalyze learning through experiential entrepreneurship
2) To help students understand the entrepreneurial context, and how it can create better outcomes.
3) To help students identify the best role for themselves within an entrepreneurial organization.

Student Learning Outcomes: 1) Gain experience with effectively refining ideas and pivoting based on feedback and external factors.
2) Gain experience building effective teams to develop and execute an idea
3) Become comfortable with failure and how to learn from failure.
4) Become adept at succinctly communicating ideas in terms of value proposition and business viability.

Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of seminar per week

Summer:
6 weeks - 10 hours of seminar per week
8 weeks - 7.5 hours of seminar per week
10 weeks - 6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructors: Goldberg, Sidhu, Wroblewki, IEOR / CET Instructors

Challenge Lab: Read Less [-]

IND ENG 186 Product Management 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
Too often we are enamored in our brilliant ideas, we skip the most important part: building products consumers will want and use. Precious time and effort is wasted on engineering perfect products only to launch to no users. This course teaches product management skills such as attributes of great product managers, reducing risk and cost while accelerating time to market, product life cycle, stakeholder management and effective development processes.
Product Management: Read More [+]
Objectives Outcomes

Course Objectives: • Students will experience a live development of a product within the context of a product development process.
• Students will learn common methods used in product management
• Students will understand the difference between engineering design and product development as a process commonly used in new venture environments.

Student Learning Outcomes: • Students will actually develop a real world functioning product, to be described as Minimum Viable.
• Students will be able to manage a product development process that leads to a product that is technically feasible as well as desired by customers.
• Students will gain experience needed to work as product managers in real life environments.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructors: Shen, Sidhu, IEOR / CET Instructors

Product Management: Read Less [-]

IND ENG 190A Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2016, Spring 2016
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Advanced Topics in Industrial Engineering and Operations Research: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
8 weeks - 1.5-7.5 hours of seminar per week
10 weeks - 1.5-6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Advanced Topics in Industrial Engineering and Operations Research: Read Less [-]

IND ENG 190B Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurial Marketing and Finance 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Spring 2014, Fall 2013
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurial Marketing and Finance: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
8 weeks - 1.5-7.5 hours of seminar per week
10 weeks - 1.5-6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurial Marketing and Finance: Read Less [-]

IND ENG 190C Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Advanced Topics in Industrial Engineering and Operations Research: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
8 weeks - 1.5-7.5 hours of seminar per week
10 weeks - 1.5-6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Advanced Topics in Industrial Engineering and Operations Research: Read Less [-]

IND ENG 190D Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2017, Fall 2014, Spring 2014
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Advanced Topics in Industrial Engineering and Operations Research: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
8 weeks - 1.5-7.5 hours of seminar per week
10 weeks - 1.5-6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Advanced Topics in Industrial Engineering and Operations Research: Read Less [-]

IND ENG 190E Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurship & Innovation 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2017, Fall 2014, Fall 2013
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurship & Innovation: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
6 weeks - 2.5-10 hours of seminar per week
8 weeks - 1.5-7.5 hours of seminar per week
10 weeks - 1.5-6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurship & Innovation: Read Less [-]

IND ENG 190F Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2013, Spring 2012, Spring 2011
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Advanced Topics in Industrial Engineering and Operations Research: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
8 weeks - 1.5-7.5 hours of seminar per week
10 weeks - 1.5-6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Advanced Topics in Industrial Engineering and Operations Research: Read Less [-]

IND ENG 190G Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2016, Spring 2015, Spring 2014
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Advanced Topics in Industrial Engineering and Operations Research: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of seminar per week

Summer:
8 weeks - 1.5-7.5 hours of seminar per week
10 weeks - 1.5-6 hours of seminar per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Advanced Topics in Industrial Engineering and Operations Research: Read Less [-]

IND ENG 190H Cases in Global Innovation 1 Unit

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2011
This course is designed primarily for upper-level undergraduate and graduate students interested in examining the major challenges and success factors entrepreneurs and innovators face in globalizing a company, product, or service. Over the duration of this course, students will examines case studies of early, mid-stage, and large-scale enterprises as they seek to start a new venture, introduce a new product or service, or capitalize on global economic trends to enhance their existing business. The course content exposes students interested in internationally oriented careers to the strategic thinking involved in international engagement and expansion. Cases will include both U.S. companies seeking to enter emerging markets and emerging market companies looking to expand within their own nations or into markets in developed nations. The course is focused around intensive study of actual business situations through rigorous case-study analysis.
Cases in Global Innovation: Read More [+]

Rules & Requirements

Prerequisites: Junior or Senior standing

Hours & Format

Fall and/or spring: 8 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Cases in Global Innovation: Read Less [-]

IND ENG 190I Cases in Global Innovation: China 1 Unit

Offered through: Industrial Engin and Oper Research
Terms offered: Prior to 2007
This course is designed primarily for upper-level undergraduate and graduate students interested in examining the major challenges and success factors entrepreneurs and innovators face in globalizing a company product or service, with a focus on China. Over the duration of this course, students will examine case studies of foreign companies seeking to start a new venture, introduce a new product or service to the China market, or domestic Chinese companies seeking to adapt a U.S. or western business model to the China market. The course content exposes students interested in internationally oriented careers to the strategic thinking involved in international engagement and expansion and the particularities of the China market and their contrast with the U.S. market. The course is focused around intensive study of actual business situations through rigorous case-study analysis and the course size is limited to 30.
Cases in Global Innovation: China: Read More [+]
Rules & Requirements

Prerequisites: Junior or senior standing. Recommended, but not required to be taken after or along with Engineering 198

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Sidhu

Cases in Global Innovation: China: Read Less [-]

IND ENG 190K Cases in Global Innovation: South Asia 1 Unit

Offered through: Industrial Engin and Oper Research
Terms offered: Prior to 2007
This course is designed primarily for upper-level undergraduate and graduate students interested in examining the major challenges and success factors entrepreneurs and innovators face in conducting business, globalizing a company product or service, or investing in South Asia. Over the duration of this course, students will examine case studies of foreign companies seeking to start a new venture, introduce a new product or service to the South Asian market, or South Asian companies seeking to adapt a U.S or western business model. The course will put this into the larger context of the political, economic, and social climate in several South Asian countries and explore the constraints to doing business, as well as the policy changes that have allowed for a more conducive business environment.
Cases in Global Innovation: South Asia: Read More [+]
Rules & Requirements

Prerequisites: Junior or senior standing. Recommended but not required to be taken after or along with Engineering 198

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Sidhu

Cases in Global Innovation: South Asia: Read Less [-]

IND ENG 191 Technology Entrepreneurship 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
This course explores key entrepreneurial concepts relevant to the high-technology world. Topics include the entrepreneurial perspective, start-up strategies, business idea evaluation, business plan writing, introduction to entrepreneurial finance and venture capital, managing growth, and delivering innovative products. This course prepares technical and business minded students for careers focused on entrepreneurship, intrapreneurship, and high technology. Students undertake intensive study of actual business situations through rigorous case-study analysis. This course can not be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Technology Entrepreneurship: Read More [+]

Rules & Requirements

Prerequisites: Junior or senior standing

Credit Restrictions: Students will receive no credit for 191 after taking 190A prior to fall 2009.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Sidhu

Technology Entrepreneurship: Read Less [-]

IND ENG 192 Berkeley Method of Entrepreneurship Bootcamp 2 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Summer 2017 Second 6 Week Session
This course offers the opportunity to understand the Berkeley Method of Entrepreneurship (BME) in an intensive format. The BME curriculum conveys the latest approaches for training global technology entrepreneurs. This method leverages insights on strategy, tactics, culture, and psychology with an accompanying entrepreneurial infrastructure. The curriculum is structured to provide an optimal global entrepreneurship experience from real life experiences.
Berkeley Method of Entrepreneurship Bootcamp: Read More [+]

Objectives Outcomes

Course Objectives: * To understand and make use of the value of diversity in idea generation and new venture creation.
Student should become aware of the infrastructure available through UC Berkeley that an support them in developing new ventures.
To understand common tactics in starting new ventures including a lean learning cycle.
To understand the mindset of an entrepreneur, including the soft skills, behaviors, and psychological factors most likely to be needed to develop a new venture.

Student Learning Outcomes: Students should be able to consider a greater number of ideas for global entrepreneurship by observing the effect of background diversity in the class.
Students should be able to follow a process of idea generation, rapid prototyping / venture story development, attraction of stakeholders, data collection, and hypothesis testing and regeneration.
Students should become aware of the mindset and behaviour required for entreprenurship and be able to reinforce some of these behavious (eg rejection tolerance, comfort with failing or being wrong, inductive learning, venture story telling/communication abilities) through excercizes in the program.

Hours & Format

Fall and/or spring: 1 weeks - 30 hours of lecture and 20 hours of discussion per week

Summer: 3 weeks - 30 hours of lecture and 20 hours of discussion per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructors: Sidhu, Ikhlaq

Berkeley Method of Entrepreneurship Bootcamp: Read Less [-]

IND ENG 195 A. Richard Newton Lecture Series 1 Unit

Offered through: Industrial Engin and Oper Research
Terms offered: Spring 2018, Fall 2017, Spring 2017
This lecture series serves as an entry point for undergraduate and graduate curriculum sequences in entrepreneurship and innovation. The series, established in 2005, is named in honor of A. Richard Newton, a visionary technology industry leader and late dean of the University of California Berkeley College of Engineering. The course features a selection of high-level industry speakers who share their insights on industry developments, leadership, and innovation based on their careers.
A. Richard Newton Lecture Series: Read More [+]
Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of colloquium per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Alternative to final exam.

Instructor: Sidhu

A. Richard Newton Lecture Series: Read Less [-]

IND ENG H196A Operations Research and Management Science Honors Thesis 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Prior to 2007
Individual study and research for at least one academic year on a special problem approved by a member of the faculty; preparation of the thesis on broader aspects of this work.
Operations Research and Management Science Honors Thesis: Read More [+]
Rules & Requirements

Prerequisites: Open only to students in the honors program

Credit Restrictions: Course may be repeated for credit with consent of instructor.

Repeat rules: Course may be repeated for credit with consent of instructor. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of independent study per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam required.

Operations Research and Management Science Honors Thesis: Read Less [-]

IND ENG H196B Operations Research and Management Science Honors Thesis 3 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Prior to 2007
Individual study and research for at least one academic year on a special problem approved by a member of the faculty; preparation of the thesis on broader aspects of this work.
Operations Research and Management Science Honors Thesis: Read More [+]
Rules & Requirements

Prerequisites: Open only to students in the honors program

Repeat rules: Course may be repeated for credit with consent of instructor. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of independent study per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam required.

Operations Research and Management Science Honors Thesis: Read Less [-]

IND ENG 197 Undergraduate Field Research in Industrial Engineering 1 - 12 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Summer 2017 10 Week Session, Summer 2016 10 Week Session
Students work on a field project under the supervision of a faculty member. Course does not satisfy unit or residence requirements for bachelor's degree.
Undergraduate Field Research in Industrial Engineering: Read More [+]
Rules & Requirements

Prerequisites: Completion of two semesters of coursework

Repeat rules: Course may be repeated for credit.

Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of fieldwork per week

Summer:
6 weeks - 2.5-30 hours of fieldwork per week
8 weeks - 1.5-22.5 hours of fieldwork per week
10 weeks - 1.5-18 hours of fieldwork per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Undergraduate Field Research in Industrial Engineering: Read Less [-]

IND ENG 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Fall 2016, Spring 2016, Fall 2015
Group studies of selected topics. Semester course unit value and contact hours will have a one-to-one ratio.
Directed Group Studies for Advanced Undergraduates: Read More [+]

Rules & Requirements

Prerequisites: Senior standing in Engineering

Repeat rules: Course may be repeated for credit.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Studies for Advanced Undergraduates: Read Less [-]

IND ENG 199 Supervised Independent Study 1 - 4 Units

Offered through: Industrial Engin and Oper Research
Terms offered: Summer 2016 10 Week Session, Summer 2015 10 Week Session, Spring 2015
Supervised independent study. Enrollment restrictions apply.
Supervised Independent Study: Read More [+]

Rules & Requirements

Prerequisites: Consent of instructor and major adviser

Credit Restrictions: Course may be repeated for a maximum of four units per semester.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:
6 weeks - 2.5-10 hours of independent study per week
8 weeks - 2-7.5 hours of independent study per week
10 weeks - 1.5-6 hours of independent study per week

Additional Details

Subject/Course Level: Industrial Engin and Oper Research/ Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study: Read Less [-]