Operations Research and Management Science

Bachelor of Arts (BA)

The Operations Research and Management Science (ORMS) major is designed for students in the College of Letters and Science. It provides a solid foundation in the quantitative, model building, and problem solving skills of operations research and management science. It also gives students the flexibility to learn more about a particular field of interest to them in which they can apply these skills.

The major is appropriate for students who enjoy and are good at mathematics, computers, and solving practical, multi-disciplinary problems. Keep in mind that the program is very math-intensive. This may not be the right program for students who think math is a difficult subject.

Declaring the Major

Students can declare a major after they have completed at least one semester at UC Berkeley. The ORMS major is impacted. To be considered for admission, students should have a minimum of a 3.2 overall grade point average (GPA) in the prerequisite courses. Applications must be submitted by invitation only. To be considered for invitation, request to be added to the waiting list by contacting Anayancy Paz, 4145 Etcheverry Hall. The program plan cannot be approved if students will have completed more than 80 semester units prior to their last intended semester (AP units do not count towards this 80-unit ceiling).

All four prerequisite classes (MATH 53, MATH 54, ECON 1, ECON 2 or ECON 3 and UGBA 10) must be completed prior to acceptance to the major and all must be taken for a letter grade. Students should apply to the major at the end of the semester in which they are enrolled in their final prerequisites. Transfer students should apply at the end of their first semester at Berkeley. Admissions decisions will not be made until any prerequisite courses in progress are finished and grades are available.

Many factors are considered in determining admission. The main criterion is academic performance as measured by the Berkeley GPA in the prerequisite courses.

The petition to declare a major is available from L&S office in Campbell Hall or from the L&S website (http://ls-advise.berkeley.edu/fp/fp.html) .

Since this major is capped, it is a good idea to have a backup plan. There is an Operations Research concentration in the Math department that might be a good choice, if students are not admitted to the ORMS major.

Honors Program

Students with a grade point average (GPA) of at least 3.5 overall and 3.7 in the major should consider participating in the ORMS honors program. To graduate with honors, a student must find a faculty sponsor appropriate for an original research project that he or she wishes to do and enroll in two semesters (6 units) of the honors thesis course.

Alternatively, a student may take two approved graduate courses in Operations Research or a related field, and achieve at least an A- in each course. The student must also maintain a minimum 3.5 overall GPA and 3.7 in the major.

Minor Program

There is no minor program in Operations Research and Management Science.

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a *Pass/No Pass* basis only. Other exceptions to this requirement are noted as applicable.
2. No more than one upper-division course may be used to simultaneously fulfill requirements for a student's major and minor programs, with the exception of minors offered outside of the College of Letters and Science.
3. A minimum grade point average (GPA) of 2.0 must be maintained in both upper- and lower-division courses used to fulfill the major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements 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
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
UGBA 10	Principles of Business	3
ECON 1	Introduction to Economics	4
or ECON 2	Introduction to Economics--Lecture Format	
or ECON C3	Introduction to Environmental Economics and Policy	

Upper-division Requirements

STAT 134	Concepts of Probability	3
or IND ENG 172	Probability and Risk Analysis for Engineers	
ECON 101A	Economic Theory--Micro	4
IND ENG 131	Discrete Event Simulation	3
IND ENG 160	Operations Research I	3
or IND ENG 162	Linear Programming	
IND ENG 161	Operations Research II	3
Four clustered electives (see below for sample clusters):		12

ORMS majors, with the signed advance approval of their faculty advisors, select a minimum of four upper-division elective courses to form a coherent cluster, or concentration, in an area where Operations Research is applied. Courses in other departments may count toward this requirement if they have substantial relevant content at an appropriately advanced level.

Sample Clusters

Decision Making in Economic Systems

ECON 101B	Economic Theory--Macro	4
ECON 104	Advanced Microeconomic Theory	4
ECON 141	Econometric Analysis	4
ECON C142	Applied Econometrics and Public Policy	4
ECON C110	Game Theory in the Social Sciences	4
IND ENG 165	Engineering Statistics, Quality Control, and Forcasting	3
MATH 104	Introduction to Analysis	4
UGBA 143	Game Theory and Business Decisions	3

Decision Making in Industrial and Service Systems

IND ENG 115	Industrial and Commercial Data Systems	3
IND ENG 150	Production Systems Analysis	3
IND ENG 151	Service Operations Design and Analysis	3
IND ENG 153	Logistics Network Design and Supply Chain Management	3
IND ENG 160	Operations Research I	3
or IND ENG 162	Linear Programming	
IND ENG 165	Engineering Statistics, Quality Control, and Forcasting	3
IND ENG 130	Methods of Manufacturing Improvement	3
IND ENG 166	Decision Analysis	3
IND ENG 170	Industrial Design and Human Factors	3
UGBA 102B	Introduction to Managerial Accounting	3
UGBA 141	Production and Operations Management	3
UGBA 143	Game Theory and Business Decisions	3

Decision Making in Societal Systems

IND ENG 165	Engineering Statistics, Quality Control, and Forcasting	3
ECON 101A	Economic Theory--Micro	4
ECON C110	Game Theory in the Social Sciences	4
SOCIOL 101A	Course Not Available	5
SOCIOL 105	Research Design and Sociological Methods	5
SOCIOL 106	Quantitative Sociological Methods	4
SOCIOL 119	Course Not Available	4
UGBA 143	Game Theory and Business Decisions	3

Algorithmic Decision Making

COMPSCI 61B	Data Structures	4
COMPSCI 170	Efficient Algorithms and Intractable Problems	4
COMPSCI 172	Computability and Complexity	4
COMPSCI 174	Combinatorics and Discrete Probability	4
IND ENG 115	Industrial and Commercial Data Systems	3
IND ENG 160	Operations Research I	3
or IND ENG 162	Linear Programming	
IND ENG 166	Decision Analysis	3
MATH 110	Linear Algebra	4

Undergraduate students in the College of Letters and Science must fulfill the following requirements in addition to those required by their major program.

For detailed lists of courses that fulfill college requirements, please see the College of Letters and Sciences (http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/letters-science) page in this bulletin.

Entry Level Writing

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing Requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

American History and American Institutions

The American History and Institutions requirements are based on the principle that a U.S. resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

American Cultures

American Cultures is the one requirement that all undergraduate students at Cal need to take and pass in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture of the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

Quantitative Reasoning

The Quantitative Reasoning requirement is designed to ensure that students graduate with basic understanding and competency in math, statistics, or computer science. The requirement may be satisfied by exam or by taking an approved course.

Foreign Language

The Foreign Language requirement may be satisfied by demonstrating proficiency in reading comprehension, writing, and conversation in a foreign language equivalent to the second semester college level, either by passing an exam or by completing approved course work.

Reading and Composition

In order to provide a solid foundation in reading, writing and critical thinking the College requires two semesters of lower division work in composition. Students must complete a first-level reading and composition course by the end of their second semester and a second-level course by the end of their fourth semester.

Breadth Requirements

The undergraduate breadth requirements provide Berkeley students with a rich and varied educational experience outside of their major program. As the foundation of a liberal arts education, breadth courses give

students a view into the intellectual life of the University while introducing them to a multitude of perspectives and approaches to research and scholarship. Engaging students in new disciplines and with peers from other majors, the breadth experience strengthens interdisciplinary connections and context that prepares Berkeley graduates to understand and solve the complex issues of their day.

Unit Requirements

- 120 total units, including at least 60 L&S units
- Of the 120 units, 36 must be upper division units
- Of the 36 upper division units, 6 must be taken in courses offered outside your major department

Residence Requirements

For units to be considered in "residence," you must be registered in courses on the Berkeley campus as a student in the College of Letters and Science. Most students automatically fulfill the residence requirement by attending classes here for four years. In general, there is no need to be concerned about this requirement, unless you go abroad for a semester or year or want to take courses at another institution or through University Extension during your senior year. In these cases, you should make an appointment to see an adviser to determine how you can meet the Senior Residence Requirement.

Note: Courses taken through UC Extension do not count toward residence.

Senior Residence Requirement

After you become a senior (with 90 semester units earned toward your B.A. degree), you must complete at least 24 of the remaining 30 units in residence in at least two semesters. To count as residence, a semester must consist of at least 6 passed units. Intercampus Visitor, EAP, and UC Berkeley-Washington Program (UCDC) units are excluded.

You may use a Berkeley summer session to satisfy one semester of the Senior Residence Requirement, provided that you successfully complete 6 units of course work in the Summer Session and that you have been enrolled previously in the College.

Modified Senior Residence Requirement

Participants in the UC Education Abroad Program (EAP) or the UC Berkeley-Washington Program (UCDC) may meet a Modified Senior Residence Requirement by completing 24 (excluding EAP) of their final 60 semester units in residence. At least 12 of these 24 units must be completed after you have completed 90 units.

Upper Division Residence Requirement

You must complete in residence a minimum of 18 units of upper division courses (excluding EAP units), 12 of which must satisfy the requirements for your major.

Learning Goals for the Major

All Operations Research and Management Science (ORMS) graduates are expected to acquire the following general skills and knowledge:

1. Ability to apply mathematics and science to the solution of societal problems
2. Ability to design and conduct experiments, analyze, and interpret data
3. Ability to design system and operating policies to meet desired needs
4. Ability to function on multi-disciplinary teams and communicate effectively
5. Ability to identify, formulate, and solve societal system problems
6. Understanding of professional and ethical responsibility
7. Recognize the need for and ability to engage in life-long learning
8. Knowledge of contemporary issues
9. Ability to use techniques, skills, and modern tools in practice

Skills

The ORMS major in the IEOR Department has four general objectives for the Bachelor of Arts degree program. The Department aims for the BA degree graduates to become skilled in the following:

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 and analysis of data and the use of database and decision-support tools
4. Comprehension and analysis of risk and uncertainty

In addition, graduates will obtain the broader skills, background, and knowledge necessary to be effective life-long professionals who understand the impact of systems in a societal context in a rapidly changing global economy.

Specific outcomes of the BA degree program are as follows:

1. Develop scientific, quantitative, model building, and problem solving skills through core courses in mathematics, statistics, operations research, and management sciences
2. Learn how to apply these skills and tools effectively for operational, tactical, and strategic decisions in scientific solving problems in an area of choice
3. Pursue graduate study in Operations Research and the Management Sciences

Operations Research and Management Science

IND ENG 24 Freshman Seminars 1 Unit
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.
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.

IND ENG 98 Supervised Group Study and Research 1 - 3 Units
Supervised group study and research by lower division students.
Rules & Requirements

Prerequisites: Consent of instructor

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

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

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.

IND ENG 99 Supervised Independent Study and Research 1 - 4 Units
Supervised independent study for lower division students.
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.

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

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.

IND ENG 115 Industrial and Commercial Data Systems 3 Units
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.
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

IND ENG 130 Methods of Manufacturing Improvement 3 Units
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.
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

IND ENG 131 Discrete Event Simulation 3 Units
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.
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

IND ENG 150 Production Systems Analysis 3 Units
Quantitative models for operational and tactical decision making in production systems, including production planning, inventory control, forecasting, and scheduling.
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

IND ENG 151 Service Operations Design and Analysis 3 Units
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.
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.

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

IND ENG 160 Operations Research I 3 Units
Deterministic methods and models in operations research. Unconstrained and constrained optimization. Equality, inequality, and integer constraints. Sequential decisions; dynamic programming. Resource allocation, equipment replacement, inventory control, production planning.
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

IND ENG 161 Operations Research II 3 Units
Probability review. Conditional expectation. The exponential distribution and Poisson process. Discrete and continuous-time Markov chains. Applications reliability, transportation, inventory, queueing, financial, and communications models.
Rules & Requirements

Prerequisites: Industrial Engineering 172 or Statistics 134

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.

IND ENG 162 Linear Programming 3 Units
Formulation to linear programs. Optimal allocation and control problems in industry and 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.
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.

IND ENG S162 Linear Programming 3 Units
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.
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.

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

IND ENG 166 Decision Analysis 3 Units
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.
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

IND ENG 170 Industrial Design and Human Factors 3 Units
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.
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

IND ENG 171 Technology Firm Leadership 3 Units
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.
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. Course may be repeated for credit when topic changes.

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.

IND ENG 172 Probability and Risk Analysis for Engineers 3 Units
This is an introductory probability course for students in engineering. It focuses mostly on random variables and their applications. Applications will be given in such areas as reliability theory, risk theory, inventory theory, financial models, computer science, and others. Note: This course is a statistics course and cannot be used to fulfill any engineering unit or elective requirements.
Rules & Requirements

Prerequisites: Mathematics 1A-1B or 16A-16B

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

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

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.

IND ENG 180 Senior Project 4 Units
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.
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.

IND ENG 185 Challenge Lab 4 Units
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.
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

IND ENG 186 Product Management 3 Units
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.
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

IND ENG 190A Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Rules & Requirements

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

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.

IND ENG 190B Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurial Marketing and Finance 1 - 4 Units
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Rules & Requirements

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

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.

IND ENG 190C Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Rules & Requirements

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

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.

IND ENG 190D Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Rules & Requirements

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

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.

IND ENG 190E Advanced Topics in Industrial Engineering and Operations Research: Entrepreneurship & Innovation 1 - 4 Units
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Rules & Requirements

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

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.

IND ENG 190F Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Rules & Requirements

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

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.

IND ENG 190G Advanced Topics in Industrial Engineering and Operations Research 1 - 4 Units
The 190 series cannot be used to fulfill any engineering requirement (engineering units, courses, technical electives, or otherwise).
Rules & Requirements

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

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.

IND ENG 190H Cases in Global Innovation 1 Unit
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.
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.

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

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

IND ENG 191 Technology Entrepreneurship 3 Units
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).
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

IND ENG 192 Berkeley Method of Entrepreneurship Bootcamp 1 Unit
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.
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 - 15 hours of lecture and 15 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.

Instructor: IEOR / CET Instructors

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

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

IND ENG 197 Undergraduate Field Research in Industrial Engineering 1 - 12 Units
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.
Rules & Requirements

Prerequisites: Completion of two semesters of coursework

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

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.

IND ENG 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units
Group studies of selected topics. Semester course unit value and contact hours will have a one-to-one ratio.
Rules & Requirements

Prerequisites: Senior standing in Engineering

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

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.

IND ENG 199 Supervised Independent Study 1 - 4 Units
Supervised independent study. Enrollment restrictions apply.
Rules & Requirements

Prerequisites: Consent of instructor and major adviser

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

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

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.