Engineering Mathematics and Statistics

Bachelor of Science (BS)

The Engineering Mathematics and Statistics major offered through the Engineering Science Program offers students an opportunity to study pure and applied mathematics as essential components of modern engineering. By combining courses in pure mathematics, applied mathematics, statistics, the physical sciences, and engineering, a student may individualize a program of study, of theory, or of applications of both. It provides a broad foundation for graduate studies in theoretical branches of engineering, as well as in mathematics, and can prepare students for a career in specific sectors of industry or business.

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 Science degree programs via a Change of College application for current UC Berkeley students is competitive as there are few — if any — spaces available in this major for students admitted to other colleges at UC Berkeley. For further information regarding a Change to College of Engineering, please see the College's website (http://coe.berkeley.edu/students/current-undergraduates/change-of-college/).

Minor Program

There is no minor program in Engineering Mathematics and Statistics.

Other Majors offered by the Engineering Science Program

Energy Engineering (https://guide.berkeley.edu/undergraduate/degree-programs/energy-engineering/) (Major and Minor)
Engineering Physics (https://guide.berkeley.edu/undergraduate/degree-programs/engineering-physics/) (Major)
Environmental Engineering Science (https://guide.berkeley.edu/undergraduate/degree-programs/environmental-engineering-science/) (Major)

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 taken in satisfaction of major requirements 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 Major Requirements

MATH 51/1A	Calculus I (MATH 51 as of Fall 2025)	4
MATH 52/1B	Calculus II (MATH 52 as of Fall 2025)	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
CHEM 4A	General Chemistry and Quantitative Analysis [1]	5
or CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
PHYSICS 7C	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming and Numerical Methods	4
or COMPSCI 61A	The Structure and Interpretation of Computer Programs	
ENGIN 177	Advanced Programming with MATLAB	3-4
or COMPSCI 6	Data Structures	
or COMPSCI 6	Data Structures and Programming Methodology	
Lower division technical electives		
Select two from the following: [2]		
COMPSCI C8	Foundations of Data Science [4]	
COMPSCI 61A	The Structure and Interpretation of Computer Programs [4] [3]	
COMPSCI 61B	Data Structures [4] [3]	
or COMPSCI 61B	Data Structures and Programming Methodology	
COMPSCI 61C	Great Ideas of Computer Architecture (Machine Structures) [4]	
or COMPSC	Course Not Available	
COMPSCI 70	Discrete Mathematics and Probability Theory [4]	
EECS 16A	Foundations of Signals, Dynamical Systems, and Information Processing [4]	
EECS 16B	Introduction to Circuits & Devices [4]	
ENGIN 7	Introduction to Computer Programming and Numerical Methods [4] [3]	
ENGIN 29	Manufacturing and Design Communication [4]	
MAT SCI 45 & 45L	Properties of Materials and Properties of Materials Laboratory	
MATH 55	Discrete Mathematics [4]	
MEC ENG C85/ CIV ENG C30	Introduction to Solid Mechanics [3]	

[1] CHEM 4A is intended for students majoring in chemistry or a closely-related field.
[2] Other courses may be used if approved by a faculty adviser.

[3] This course may only be used as a lower division technical elective if not being used to satisfy other requirements above.

Upper Division Requirements

Due to the interdisciplinary nature of this major, electives must be selected and approved in consultation with a faculty adviser.

MATH 110	Abstract Linear Algebra	4
MATH 104	Introduction to Analysis	4
MATH 105	Second Course in Analysis	4
or MATH 185	Introduction to Complex Analysis	
MATH 128A	Numerical Analysis	4
STAT 134	Concepts of Probability	4
or EECS 126	Probability and Random Processes	
or STAT C140	Probability for Data Science	
or IND ENG 172	Probability and Risk Analysis for Engineers	
Select three math/statistics technical electives		10-12
Select one course in mathematics, one course in statistics, and one course from either, from the following:		
MATH H104	Honors Introduction to Analysis [4]	
MATH 105	Second Course in Analysis [4]	
MATH H113	Honors Introduction to Abstract Algebra [4]	
MATH 113	Introduction to Abstract Algebra [4]	
MATH 114	Second Course in Abstract Algebra [4]	
MATH 115	Introduction to Number Theory [4]	
MATH 116	Cryptography [4]	
MATH 118	Fourier Analysis, Wavelets, and Signal Processing [4]	
MATH 121A	Mathematical Tools for the Physical Sciences [4]	
MATH 121B	Mathematical Tools for the Physical Sciences [4]	
MATH 123	Ordinary Differential Equations [4]	
MATH 124	Programming for Mathematical Applications [4]	
MATH 126	Introduction to Partial Differential Equations [4]	
MATH 127	Mathematical and Computational Methods in Molecular Biology [4]	
MATH 128B	Numerical Analysis [4]	
MATH 130	Groups and Geometries [4]	
MATH 136	Incompleteness and Undecidability [4]	
MATH 140	Metric Differential Geometry [4]	
MATH 141	Elementary Differential Topology [4]	
MATH 142	Elementary Algebraic Topology [4]	
MATH 143	Elementary Algebraic Geometry [4]	
MATH 151	Mathematics of the Secondary School Curriculum I [4]	
MATH 152	Mathematics of the Secondary School Curriculum II [4]	
MATH 170	Mathematical Methods for Optimization [4]	
MATH 172	Combinatorics [4]	
MATH H185	Honors Introduction to Complex Analysis [4]	
MATH 185	Introduction to Complex Analysis [4]	
MATH 189	Mathematical Methods in Classical and Quantum Mechanics [4]	
ENGIN 117	Methods of Engineering Analysis [3] (counts as a Math Elective)	
STAT 135	Concepts of Statistics [4]	
STAT 150	Stochastic Processes [3]	
STAT 151A	Linear Modelling: Theory and Applications [4]	
STAT 152	Sampling Surveys [4]	
STAT 153	Introduction to Time Series [4]	
STAT 154	Modern Statistical Prediction and Machine Learning [4]	
STAT 157	Seminar on Topics in Probability and Statistics [3]	
STAT 158	Experimental Design [4]	
STAT 165	Forecasting [3]	
Additional upper division technical electives: select 16 units of upper division engineering courses, in consultation with faculty adviser [1]		16

[1] Technical electives must include 16 units of upper division engineering courses, selected in consultation with the student's faculty adviser, in order to provide depth in an area of engineering with high mathematical content—typically, most of these courses will come from a single engineering department, but courses that complement each other from different departments are also permissible. Engineering courses cannot include: any course taken on a P/NP basis; BIO ENG 100, DATA C104, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, ENGIN 180, ENGIN 183 series, ENGIN 185, ENGIN 187, ENGIN 195 series, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 190K, 191AC, 191K. Graded research units (such as H194 or 196) are reviewed on a case by case basis and may be petitioned.

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 (https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/major-programs/) 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) that can fulfill requirements for the student's major 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 five semesters to complete their degree requirements. 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 (https://engineering.berkeley.edu/students/undergraduate-guide/policies-procedures/) as they complete degree requirements.
7. Complete lower division technical courses before enrolling in upper division technical courses.

Humanities and Social Sciences (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. See the humanities and social sciences (https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/humanities-and-social-sciences/) section of our website for details.

Class Schedule Requirements

- Minimum units per semester: 12.0
- Maximum units per semester: 20.5
- Minimum technical courses: College of Engineering undergraduates must include at least two letter graded technical courses (of at least 3 units each) in their semester program. Every semester students are expected to make normal progress in their declared major. Normal progress is determined by the student's Engineering Student Services Advisor. (Note: For most majors, normal progress (https://engineering.berkeley.edu/academics/undergraduate-guide/policies-procedures/scholarship-progress/#ac12282) will require enrolling in 3-4 technical courses required of your current major each semester.) Students who are not in compliance with this policy by the end of the fifth week of the semester are subject to a registration block that will delay enrollment for the following semester.
- All technical courses (math, science, engineering) that satisfy requirements for the major must be taken on a letter-graded basis (unless only offered as P/NP).

Minimum Academic Requirements

- Students must have a minimum overall and semester grade point average of 2.00 (C average). Students will be subject to suspension or 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 for the major curriculum each semester.
- A minimum overall grade point average of 2.00 and a minimum 2.00 grade point average in upper division technical course work required for the major are required to earn a Bachelor of Science in the College of Engineering.
- Students must make normal degree progress toward the Bachelor of Science degree and their officially declared major.

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 (https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/major-programs/) of study.
- A maximum of 16 units of special studies coursework (courses numbered 97, 98, 99, 197, 198, or 199) is allowed to count towards the B.S. degree, and no more than 4 units in any single term can be counted.
- A maximum of 4 units of physical education from any school attended will count towards the 120 units.
- Passed (P) grades may account for no more than one third of the total units completed at UC Berkeley, Fall Program for First Semester (FPF), UC Education Abroad Program (UCEAP), or UC Berkeley Washington Program (UCDC) toward the 120 overall minimum unit requirement. Transfer credit is not factored into the limit. This includes transfer units from outside of the UC system, other UC campuses, credit-bearing exams, as well as UC Berkeley Extension XB units.

Normal Progress

Students in the College of Engineering must enroll in a full-time program and make normal progress (https://engineering.berkeley.edu/students/undergraduate-guide/policies-procedures/scholarship-progress/#ac12282) each semester toward their declared major. Students who fail to achieve normal academic progress shall be subject to suspension or dismissal. (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.)

University of California Requirements

Entry Level Writing (https://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by satisfying the Entry Level Writing Requirement (ELWR). The UC Entry Level Writing Requirement website (https://admission.universityofcalifornia.edu/elwr/) provides information on how to satisfy the requirement.

American History and American Institutions (https://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)

The American History and Institutions (AH&I) requirements are based on the principle that a US resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

Campus Requirement

American Cultures (https://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)

The American Cultures requirement is a Berkeley campus requirement, one that all undergraduate students at Berkeley need to pass in order to graduate. You satisfy the requirement by passing, with a grade not lower than C- or P, an American Cultures course. You may take an American Cultures course any time during your undergraduate career at Berkeley. The requirement was instituted in 1991 to introduce students to the diverse cultures of the United States through a comparative framework. Courses are offered in more than fifty departments in many different disciplines at both the lower and upper division level.

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[1]		5 MATH 1B	4
MATH 1A		4 PHYSICS 7A	4

Reading & Composition Part A Course[5]		4	ENGIN 7 or COMPSCI 61A	4
Humanities/Social Sciences Course[5]		3-4	First Lower Division Technical Elective[2]	3-4
		16-17		**15-16**
				Sophomore
	Fall Units		**Spring Units**	
MATH 53		4	MATH 54	4
PHYSICS 7B		4	PHYSICS 7C	4
Second Lower Division Technical Elective[2]		3-4	ENGIN 177, COMPSCI 61B, or COMPSCI 61BL	3-4
Reading & Composition Part B Course[5]		4	Humanities/ Social Sciences Course[5]	3-4
		15-16		**14-16**
				Junior
	Fall Units		**Spring Units**	
MATH 104		4	MATH 105 or 185	4
MATH 110		4	MATH 128A	4
STAT 134, EECS 126, IND ENG 172, or STAT C140		4	Upper Division Technical Elective[3,4]	4
Humanities/Social Science Course[5]		3-4	Humanities/ Social Science Course[5]	3-4
		15-16		**15-16**
				Senior
	Fall Units		**Spring Units**	
Upper Division Technical Electives[3,4]		10-12	Upper Division Technical Electives[3,4]	12
Free Electives		4-5	Free Electives	4-5
		14-17		**16-17**

Total Units: 120-131

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

2 Two lower division courses in engineering, mathematics, or statistics, chosen in consultation with the faculty adviser; options include CIV ENG C30/MEC ENG C85, COMPSCI C8, COMPSCI 61A, COMPSCI 61B, COMPSCI 61BL, COMPSCI 61C, COMPSCI 61CL, COMPSCI 70, ENGIN 7, ENGIN 29, MAT SCI 45 plus MAT SCI 45L, MATH 55, but other courses may also be used if approved by a faculty adviser. Courses used to satisfy the two computer science course requirements may NOT also be used for lower division technical electives. They can only be used to complete one requirement.

3 Technical electives must include 16 units of upper division engineering courses, selected in consultation with the student's faculty adviser, in order to provide depth in an area of engineering with high mathematical content—typically, most of these courses will come from a single engineering department, but courses that complement each other from different departments are also permissible. Engineering courses cannot include: any course taken on a P/NP basis; BIO ENG 100, DATA C104, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, ENGIN 180, ENGIN 183 series, ENGIN 185, ENGIN 187, ENGIN 195 series, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 190K, MEC ENG 191AC, MEC ENG 191K. Graded research units (such as H194 or 196) are reviewed on a case by case basis and may be petitioned.

4 Three additional upper division technical courses as follows: One in mathematics, one in statistics and one from either math or statistics from among: all upper division Math courses (except MATH C103, 125A, 135, 160, and any course numbered 191 or higher) and ENGIN 117 (counts as a math elective); STAT 135, STAT 150, STAT 151A, STAT 152, STAT 153, STAT 154, STAT 157, STAT 158, STAT 165.

5 The Humanities/Social Sciences (H/SS) requirement includes two approved Reading & Composition (R&C) courses and four additional approved courses, with which a number of specific conditions must be satisfied. R&C courses must be taken for a letter grade (C- or better required). The first half (R&C Part A) must be completed by the end of the freshman year; the second half (R&C Part B) must be completed by no later than the end of the sophomore year. The remaining courses may be taken at any time during the program. See engineering.berkeley.edu/hss (https://engineering.berkeley.edu/academics/undergraduate-guide/degree-requirements/humanities-and-social-sciences/) for complete details and a list of approved courses.

Major maps are experience maps that help undergraduates plan their Berkeley journey based on intended major or field of interest. Featuring student opportunities and resources from your college and department as well as across campus, each map includes curated suggestions for planning your studies, engaging outside the classroom, and pursuing your career goals in a timeline format.

Use the major map below to explore potential paths and design your own unique undergraduate experience:

View the Engineering Mathematics and Statistics Major Map. (https://discovery.berkeley.edu/getting-started/major-maps/engineering-mathematics-statistics/)

Engineering Mathematics and Statistics

ENGIN 1 Engineering Your Life: Skills for Leadership, Discovery and Service 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course provides the framework for engineering an empowered life through leadership, discovery and service. The class focuses on development of self, emotional intelligence, strategic thinking, problem solving, teamwork, diversity, and service learning. Skills include developing of self-awareness; understanding our unique strengths; debunking the imposter syndrome; creating plans of action and setting goals; giving and receiving assessments; interpreting body language; managing time and life-balance; and creating mission statements. Teamwork skills include methods for inspiring others; variations in leadership styles and team dynamics; rhythm of action for projects and teams; difficult conversations and conflict resolution; mechanisms.
Objectives & Outcomes

Course Objectives: This course offers the requisite framework for engineering an empowered life. The course provides students with requisite skills for authentic leadership, self-discovery and societal service. These attributes are in alignment with the mission of the College of Engineering and the Berkeley campus.

Student Learning Outcomes: Students will learn how to assess personal strengths, implement plans of action and develop mission statements. Students will learn how to optimize their knowledge with assessment of learning styles along with key communication tools necessary for conflict resolution and inspiration of others (teamwork). Through a series of active exercises and self-reflection activities the students will learn requisite skills for self-discovery and the creation of a personal leadership plan.

Rules & Requirements

Prerequisites: Designed for engineering freshmen, the class is open to all students in the College of Engineering or by permission of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Pruitt

ENGIN 7 Introduction to Computer Programming and Numerical Methods 4 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Fundamentals of computer programming and numerical methods with emphasis on engineering applications. The first part of the course provides an accelerated introduction to programming in Python, suitable for novices and those with prior
experience. Topics include control structures, functions, data types, data handling, and visualization. Some programming in MATLAB will also be introduced. The second part of the course introduces several numerical methods commonly used in engineering. These include solving nonlinear equations, numerically integrating and differentiating functions, solving systems of linear equations, and simulating dynamical systems using ordinary differential equations.
Rules & Requirements

Prerequisites: MATH 52 (may be taken concurrently)

Credit Restrictions: Students will receive no credit for ENGIN 7 after completing ENGIN 77, or ENGIN W7. A deficient grade in ENGIN 7 may be removed by taking ENGIN W7.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture, 1 hour of discussion, and 4 hours of laboratory per week

Summer: 10 weeks - 3 hours of lecture, 1.5 hours of discussion, and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Formerly known as: 77

ENGIN W7 Introduction to Computer Programming for Scientists and Engineers 4 Units

Terms offered: Summer 2021 10 Week Session, Summer 2016 10 Week Session, Summer 2015 10 Week Session
Elements of procedural and object-oriented programming. Induction, iteration, and recursion. Real functions and floating-point computations for engineering analysis. Introduction to data structures. Representative examples are drawn from mathematics, science, and engineering. The course uses the MATLAB programming language.
Rules & Requirements

Prerequisites: MATH 1B (may be taken concurrently)

Credit Restrictions: Students will receive no credit for Engineering W7 after completing Engineering 7 or 77. A deficient grade in Engineering 7 or 77 may be removed by taking Engineering W7.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of web-based lecture, 4 hours of laboratory, and 1 hour of web-based discussion per week

Summer: 10 weeks - 6 hours of web-based lecture, 0 hours of laboratory, and 7.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Papadopoulos

ENGIN 11 A Hands-on Introduction to Radiation Detection: Getting to know our Radioactive World 3 Units

Terms offered: Spring 2025, Spring 2024, Fall 2023
Introduction to basic concepts in radiation detection and radioactivity, electrical circuits, and data analytics. Lectures provide the theoretical foundation of the work being performed in the accompanying laboratory. The course will contain three sections: introduction to how radiation interacts with matter and radiation detection technologies; development of the tools (mathematical and computational) needed for analyzing various types of radiation and environmental data; and building of a basic radiation sensor system.
Objectives & Outcomes

Course Objectives: The course is suitable for Nuclear Engineering students, other Engineering majors, and any students interested in gaining a general understanding of radiation detection.
The focus of this course will be on the application of the nuclear science, radiation detection, and data analysis concepts covered to the building of a multi-sensor radiation detection system, following a template for the required data acquisition software and circuit integration.
Fieldwork related to a chosen research topic will be carried out in small groups, with group oral presentations and final reports. Students will be introduced to research opportunities on campus and at nearby lab facilities through tours of lab spaces throughout the department and field trips to LBNL and LLNL.

Students will be introduced to core concepts in nuclear science, statistical analysis, and computation, while being given practical experience applying those concepts to radiation detection and data analysis.
The objective of this course is to provide Freshman and Sophomore students with an introduction to the fundamentals of nuclear radiation and radiation detection through a hands-on approach.

Student Learning Outcomes: Be able to outline and carry out a research project, prepare written and oral presentations of that work, and demonstrate how the sensors they built work.
By the end of this course, students should be able to:
Identify types of radioactivity, radiation detection methods and sources of environmental radiation,

Create simple circuit designs making use of standard circuitry components, demonstrate basic soldering skills, and demonstrate a familiarity with printed circuit board design tools,
Make use of software tools including the Python programming language, version control with git, and shell environments,
Perform statistical analysis of large data sets and quantify statistical and systematic uncertainties in experimental data,

Rules & Requirements

Credit Restrictions: Students will receive no credit for ENGIN 11 after completing ENGIN 11. A deficient grade in ENGIN 11 may be removed by taking ENGIN 11.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 24 Freshman Seminar 1 Unit

Terms offered: Fall 2025, Spring 2025, Fall 2024
The Berkeley Seminar Program is designed to provide students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Berkeley Seminars are offered in all college departments, and topics vary from department to department and semester to semester.

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 25 Visualization for Design 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019
Development of 3-dimensional visualization skills for engineering design. Sketching as a tool for design communication. Presentation of 3-dimensional geometry with 2-dimensional engineering drawings. This course will introduce the use of 2-dimensional CAD on computer workstations as a major graphical analysis and design tool. A group design project is required. Teamwork and effective communication are emphasized.

Objectives & Outcomes

Course Objectives: Improve 3-dimensional visualization skills; enable a student to create and understand engineering drawings; introduce 2-dimensional computer-aided geometry modeling as a visualization, design, and analysis tool; enhance critical thinking and design skills; emphasize communication skills, both written and oral; develop teamwork skills; offer experience in hands-on engineering projects; develop early abilities in identifying, formulating, and solving engineering problems; introduce students to the societal context of engineering practice.

Student Learning Outcomes: Upon completion of the course, students shall be able to communicate 3-dimensional geometry effectively using sketches; operate 2-dimensional CAD software with a high degree of skill and confidence; understand and create engineering drawings; visualize 3-dimensional geometry from a series of 2-dimensional drawings.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: Lieu, McMains

ENGIN 26 Three-Dimensional Modeling for Design 2 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Three-dimensional modeling for engineering design. This course will emphasize the use of CAD on computer workstations as a major graphical analysis and design tool. Students develop design skills, and practice applying these skills. A group design project, design and fabrication (3D print) of the tower and rotor is required. Hands-on creativity, teamwork, and effective communication are emphasized.

Objectives & Outcomes

Course Objectives: Develop teamwork skills; offer experience in hands-on, creative engineering projects.
Enhance critical thinking and design skills; emphasize communication skills, both written and oral.
Introduce computer-based solid, parametric, and assembly modeling as a tool for engineering design.
Reinforce the societal context of engineering practice; develop early abilities in identifying, formulating, and solving engineering problems.

Student Learning Outcomes: Create a 3D solid model of a complicated object with high degree of confidence.
Extract 2D orthographic views from the 3D model for fabrication.
Extract section and auxiliary views.
Specify the proper dimensions, according to industry standards, for parts to be fabricated.

Understand the basics of assembly and associative constraints.
Understand the basics of rapid prototyping, in particular 3D printing.
Understand the engineering design process and the implementation of different design phases.
Work effectively as a member of a design team.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: Youssefi, Mcmains

ENGIN 27 Introduction to Manufacturing and Tolerancing 2 Units

Terms offered: Summer 2021 10 Week Session, Fall 2020, Summer 2020 10 Week Session
Geometric dimensioning and tolerancing (GD&T), tolerance analysis for fabrication, fundamentals of manufacturing processes (metal cutting, welding, joining, casting, molding, and layered manufacturing).
Objectives & Outcomes

Course Objectives: Enable a student to create and understand tolerances in engineering drawings; enhance critical thinking and design skills; emphasize communication skills, both written and oral; offer hands-on experience in manufacturing; develop abilities in identifying, formulating, and solving engineering problems; introduce students to the context of engineering practice.

Student Learning Outcomes: Upon completion of the course, students shall be able to fabricate basic parts in the machine shop; understand and communicate tolerance requirements in engineering drawings using industry standard GD&T; use metrology tools to evaluate if physical parts are within specified tolerances; demonstrate familiarity with manufacturing processes; and design parts that can be fabricated realistically and economically using these processes.

Rules & Requirements

Prerequisites: ENGIN 25 (may be taken concurrently)

Hours & Format

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

Summer: 10 weeks - 1.5 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: McMains, Lieu, Taylor

ENGIN 29 Manufacturing and Design Communication 4 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
An introduction to manufacturing process technologies and the ways in which dimensional requirements for manufactured objects are precisely communicated, especially through graphical means. Fundamentals of cutting, casting, molding, additive manufacturing, and joining processes are introduced. Geometric dimensioning and tolerancing (GD&T), tolerance analysis for fabrication, concepts of process variability, and metrology techniques are introduced and practiced. 3-D visualization skills for engineering design are developed via sketching and presentation of 3-D geometries with 2-D engineering drawings. Computer-aided design software is used. Teamwork and effective communication are emphasized through lab activities and a design project.
Objectives & Outcomes

Course Objectives: Develop early abilities in identifying, formulating, and solving engineering problems.
Emphasize communication skills, both written and oral; develop teamwork skills.
Enable a student to create and understand tolerances in engineering drawings.
Enhance critical thinking and design skills.
Improve 3-dimensional visualization skills; enable a student to create and understand engineering drawings.
Introduce 2-dimensional computer-aided geometry modeling as a visualization, design, and analysis tool.
Introduce students to the societal context of engineering practice.
Offer an experience in hands-on engineering projects.

Student Learning Outcomes: A knowledge of contemporary issues.
A recognition of the need for, and an ability to engage in life-long learning.
An ability to apply knowledge of mathematics, science, and engineering.
An ability to communicate effectively.
An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
An ability to design and conduct experiments, as well as to analyze and interpret data.
An ability to identify, formulate, and solve engineering problems.
An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
An understanding of professional and ethical responsibility.

Rules & Requirements

Prerequisites: ENGIN 26 or equivalent experience in three-dimensional solid modeling (e.g. Solidworks, Fusion 360) is recommended

Hours & Format

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

Summer: 10 weeks - 4.5 hours of lecture and 4.5 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: Taylor, Hayden, Mcmains, Sarah, Stuart, Hannah

ENGIN 39B Freshman/Sophomore Seminar 1.5 - 4 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 39E Freshman/Sophomore Seminar 1.5 - 4 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 39F Freshman/Sophomore Seminar 1.5 - 4 Units

Terms offered: Fall 2010
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1.5-4 hours of seminar per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 40 Engineering Thermodynamics 4 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Fundamental laws of thermodynamics for simple substances; application to flow processes and to nonreacting mixtures; statistical thermodynamics of ideal gases and crystalline solids; chemical and materials thermodynamics; multiphase and multicomponent equilibria in reacting systems; electrochemistry. Sponsoring Departments: Materials Science and Engineering and Nuclear Engineering.

Rules & Requirements

Prerequisites: PHYSICS 7B and MATH 54. CHEM 1B recommended

Credit Restrictions: Students will receive no credit for Engineering 40 after taking Engineering 115, Chemical Engineering 141 or Mechanical Engineering 40.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: Bolind, Persson

ENGIN 47 Supplementary Work in Lower Division Engineering 1 - 3 Units

Terms offered: Spring 2022, Fall 2016, Fall 2012
May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in a lower division engineering course may complete the work under this heading.
Rules & Requirements

Prerequisites: Limited to students who must make up a fraction of a required lower division course

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer: 8 weeks - 1.5-5.5 hours of independent study per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 68 Natural Hazards: Risk, Resilience, and Adaptation 3 Units

Terms offered: Not yet offered
Introduction to natural and human-induced hazards and their societal impacts. The course explores dangers posed by geologic-, atmospheric-, and climate change-hazards and their impacts. Hazards are assessed in the context of long-term societal vulnerability and risk, options for future adaptation and mitigation, and societal response.
Rules & Requirements

Prerequisites: MATH 51 (may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 92 Perspectives in Engineering 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
This series of lectures provides students, especially undeclared Engineering students, with information on the various engineering disciplines to guide them toward choice of major. Lecturers describe research activities, how they made their own career choices, and indicate future opportunities. Recommended for all Engineering Science students and required for Engineering undeclared students.
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 93 Energy Engineering Seminar 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
Weekly seminar with different speakers on energy-related topics. The goal is to expose students to a broad range of energy issues.
Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Zohdi

ENGIN 98 Directed Group Studies for Lower Division Undergraduates 1 - 4 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Seminars for group study of selected topics, which will vary from year to year. Intended for students in the lower division.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Summer:
6 weeks - 2.5-10 hours of directed group study per week
8 weeks - 1.5-7.5 hours of directed group study per week
10 weeks - 1.5-6 hours of directed group study per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 117 Methods of Engineering Analysis 3 Units

Terms offered: Fall 2023, Fall 2019, Fall 2017
Methods of theoretical engineering analysis; techniques for analyzing partial differential equations and the use of special functions related to engineering systems. Sponsoring Department: Mechanical Engineering.

Rules & Requirements

Prerequisites: MATH 53 and MATH 54

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 120 Principles of Engineering Economics 3 Units

Terms offered: Fall 2023, Fall 2022, Spring 2022
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.

Rules & Requirements

Prerequisites: Completion of 60 units of an approved engineering curriculum

Credit Restrictions: Students will receive no credit for Engineering 120 after taking Industrial 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: Engineering/Undergraduate

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

Instructor: Adler

ENGIN 125 Ethics, Engineering, and Society 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
How should engineers analyze and resolve the ethical issues inherent in engineering? This seminar-style course provides an introduction to how theories, concepts, and methods from the humanities and social science can be applied to ethical problems in engineering. Assignments incorporate group and independent research designed to provide students an opportunity to contribute novel findings to the emerging field of engineering ethics while building their analytical and communication skills. This course cannot be used to fulfill any engineering technical requirements (units or courses).

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 128 Advanced Engineering Design Graphics 3 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021
Advanced graphics tools for engineering design. Parametric solid modeling. Assembly modeling. Presentation using computer animation and multimedia techniques.

Rules & Requirements

Prerequisites: ENGIN 26

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Lieu

ENGIN 147 Supplementary Work in Upper Division Engineering 1 - 3 Units

Terms offered: Fall 2016, Fall 2015, Spring 2015
May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in an upper division engineering course may complete the work under this heading.

Rules & Requirements

Prerequisites: Limited to students who must make up a fraction of a required upper division course

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 150 Basic Modeling and Simulation Tools for Industrial Research Applications 4 Units

Terms offered: Fall 2021, Fall 2019, Fall 1997
The course emphasizes elementary modeling, numerical methods & their implementation on physical problems motivated by phenomena that students are likely to encounter in their careers, involving biomechanics, heat-transfer, structural analysis, control theory, fluid-flow, electrical conduction, diffusion, etc. This will help students develop intuition about the strengths and weaknesses of a variety of modeling & numerical methods, as well as develop intuition about modeling physical systems & strengths and weaknesses of a variety of numerical methods, including: Discretization of differential equations, Methods for solving nonlinear systems, Gradient-based methods and machine learning algorithms for optimization, stats & quantification

Rules & Requirements

Prerequisites: ENGIN 7 or COMPSCI 61A, PHYSICS 7A, MATH 53, and MATH 54

Credit Restrictions: Students will receive no credit for ENGIN 150 after completing ENGIN 150. A deficient grade in ENGIN 150 may be removed by taking ENGIN 150.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 151 Modeling and Simulation of Infectious Diseases 3 Units

Terms offered: Prior to 2007
The course emphasizes elementary modeling, numerical methods and their implementation on physical problems motivated by real-world phenomena involving various aspects of infection diseases. This course is broken into five parts: part 1-modeling and simulation of the infection zone from respiratory emission, part 2-rapid simulation of viral decontamination efficacy with uv irradiation, part 3-an agent-based computational framework for simulation of global pandemic and social response, part 4-machine learning and parameter identification, part 5-deep dive into advanced models: continuum mechanics, solid-fluid interaction and electromagnetism.

Objectives & Outcomes

Course Objectives: Comprised of an introduction to essential mathematical modeling and simulation tools needed for various aspects of the modeling and simulation of infectious diseases. Six capstone projects, drawn from Parts 1-5 are assigned, applying the modeling and simulation tools.

Rules & Requirements

Prerequisites: ENGIN 7, COMPSCI 61A, or DATA C8 + COMPSCI 88; and PHYSICS 7A; and MATH 53 AND MATH 54

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Tarek Zohdi

ENGIN 157AC Engineering, The Environment, and Society 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course engages students at the intersection of environmental justice, social justice, and engineering to explore how problems that are commonly defined in technical terms are at their roots deeply socially embedded. Through partnerships with community-based organizations, students are trained to recognize the socio-political nature of technical problems so that they may approach solutions in ways that prioritize social justice. Topics covered include environmental engineering as it relates to air, water, and soil contamination; race, class, and privilege; expertise; ethics; and engaged citizenship. This course cannot be used to complete any engineering technical unit requirements.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Also listed as: IAS 157AC

ENGIN 170A Technology Leadership 3 Units

Terms offered: Summer 2025 Second 6 Week Session, Summer 2024 Second 6 Week Session, Fall 2005
This course covers management and innovation for technology firms. It provides an in-depth look at how technology firms decide on which organization model to use in order to reduce silos and leverage the different parts of the firm to create a greater whole. Next, an in-depth look at how well structured firms optimize technology strategy and operations. The workshop then covers how optimally organized firms create innovation programs and corporate incubators.

Hours & Format

Summer:
6 weeks - 6 hours of lecture per week
6 weeks - 6 hours of lecture per week
8 weeks - 5 hours of lecture per week
8 weeks - 5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 170B Commercializing Deep Tech Innovations 3 Units

Terms offered: Summer 2024 8 Week Session, Spring 2006, Spring 2005

Commercializing deep-tech innovations requires an interdisciplinary approach that considers the development of the technology, identification of business opportunities, and consideration of legal implications. This course will explore deep technology commercialization at the interface of business, technology, and intellectual property. Students with a stem or engineering background will collaborate on real-world, deep-tech commercialization projects from leading research institutions. Students will work in teams on a technology developed by inventors from world renowned research laboratories. The student teams will analyze patents, the technology landscape, and the market to assess the potential of commercializing technology.

Objectives & Outcomes

Course Objectives: Students will read and discuss case studies related to tech strategies deployed by start-ups, and established enterprises. The course will prepare the students to analyze deep technologies from the ground up. They will deliver an oral slide presentation that answers the questions listed below in a clear and concise manner.

- What is the technology?
- What problem is your technology trying to solve?
- What are the potential markets in which it could be commercialized?
- For which application is your technology best positioned? Why?
- Who are the competitors? How does the technology compare with competing technical solutions? What are the key differences in terms of technical performance and customer utility?
- What is the market potential of your chosen application areas/segments?
- What is the SWOT of your commercial strategy in your chosen application/segment?
- What is your market entry/go to market plan? Licensing, Start-up or something else?

Rules & Requirements

Prerequisites: Students must have strong oral and written English skills, and a demonstrated background in STEM, engineering, or business

Credit Restrictions: Students will receive no credit for ENGIN 170B after completing ENGIN 170B. A deficient grade in ENGIN 170B may be removed by taking ENGIN 170B.

Hours & Format

Summer: 8 weeks - 5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 170C Agile Product Development 3 Units

Terms offered: Summer 2024 8 Week Session

This course is designed to give students the opportunity to experience a full cycle of product development by developing and refining series of prototypes leading to delivering a functioning MVP (Minimally Viable Product). Students form small teams to identify a problem, followed by ideation to come up with a product idea that will help solving a real problem. Students will be introduced to professional product development processes & approaches through series of lectures, case study analysis, simulations, and exercises. Students will then design a product that will solve these real problems and start implementing series of 3 prototypes culminating with a working product MVP.

Objectives & Outcomes

Student Learning Outcomes: The program will also allow students to develop a number of ‘soft’ skills such as leadership, team development, conflict resolution, stakeholder management, project management in an intensive, experiential learning environment that includes regular pitches and feedback from mentors. Mixed interdisciplinary teams will be created and mandated.

The art of successfully communicating the idea is critical throughout the program and in particular during the final pitches in the final week. Students will practice explaining their products throughout the course: first to their classmates and mentors followed by presenting the prototypes to real prospective users.

Hours & Format

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 170D Technology Leadership: Entrepreneurship 3 Units

Terms offered: Summer 2025 8 Week Session

Over the course of the semester, students will gain exposure to a wide variety of scenarios and decisions faced by an entrepreneur interested in starting a scalable business. Using a variety of cases, this course will explore evaluating opportunities, customer discovery, planning for and launching an entrepreneurial endeavor (especially those that could attract third party financing), fundraising, the Business Model Canvas and exit.Students will be required to employ technical abilities and multidisciplinary analysis while digesting and dissecting case studies. Class discussions will focus on issues raised in case studies, including analysis, brainstorming, diagnosis, and recommendations.

Hours & Format

Summer:
6 weeks - 6 hours of lecture per week
8 weeks - 5 hours of lecture per week
8 weeks - 5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 170E TECHNOLOGY LEADERSHIP AND AI 3 Units

Terms offered: Summer 2025 Second 6 Week Session
This course equips students with a comprehensive understanding of Artificial Intelligence (AI) and Machine Learning (ML), focusing on these technologies' historical evolution, current applications, and future opportunities. Additionally, it provides leadership frameworks to help students thrive as leaders among peers, manage AI projects effectively, and potentially found AI startups. The course culminates in exploring “human-centered AI,” blending AI with design thinking principles to advocate for a future where technology ethically and inclusively augments—rather than replaces—human capabilities in an increasingly digitized world.

Hours & Format

Summer:
6 weeks - 6 hours of lecture per week
8 weeks - 5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 177 Advanced Programming with MATLAB 3 Units

Terms offered: Spring 2017, Spring 2015, Spring 2014
The course builds an understanding, demonstrates engineering uses, and provides hand-on experience for object-oriented programming as well as exposes a practical knowledge of advanced features available in MATLAB. The course will begin with a brief review of basic MATLAB features and quickly move to class organization and functionality. The introduced concepts are reinforced by examining the advanced graphical features of MATLAB. The material will also include the effective use of programs written in C and FORTRAN, and will cover SIMULINK, a MATLAB toolbox providing for an effective ways of model simulations. Throughout the course, the emphasis will be placed on examples and homework assignments from engineering disciplines.

Rules & Requirements

Prerequisites: ENGIN 7, MATH 53 and MATH 54 (one of these math courses may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: Frenklach, Packard

ENGIN 178 Statistics and Data Science for Engineers 4 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
This course provides a foundation in data science with emphasis on the application of statistics and machine learning to engineering problems. The course combines theoretical topics in probability and statistical inference with practical methods for solving problems in code. Each topic is demonstrated with examples from engineering. These include hypothesis testing, principal component analysis, clustering, linear regression, time series analysis, classification, and deep learning. Math 53 and 54 are recommended before Engin 178, Math 53 and 54 are allowed concurrently.

Objectives & Outcomes

Course Objectives: To demonstrate the use of data science in engineering tasks.
To enable students to import, clean, visualize, and interpret data sets using modern computer languages.
To familiarize students with a range of techniques for building models from data.
To introduce the concepts of quantitative statistics and probability.
To provide a theoretical and conceptual basis for students to understand the role of data in engineering.
To teach students how to build and train machine learning models.

Student Learning Outcomes: A knowledge of contemporary issues.
An ability to apply knowledge of mathematics, science, and engineering.
An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
An ability to design and conduct experiments, as well as to analyze and interpret data.
An ability to identify, formulate, and solve engineering problems.
An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Rules & Requirements

Prerequisites: ENGIN 7; MATH 51; MATH 51; MATH 53; and MATH 54 (may be taken concurrently)

Credit Restrictions: Students will receive no credit for ENGIN 178 after completing ENGIN 78. A deficient grade in ENGIN 178 may be removed by taking ENGIN 78.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Papadopoulos

ENGIN 180 Preparing for the Fields and Jobs of the Future 3 Units

Terms offered: Spring 2018
The course is concerned with giving students the tools to prepare for the fields and jobs of the future.
Across all university departments and majors, the numbers of students who do not work in the fields in which they've received their degrees is not only significant, but growing. For example, anywhere from 20-40% of STEM graduates do not work in the fields in which they received their degrees.
This does not mean that students shouldn't major in STEM, but that one of the primary purposes of higher education is learning how to learn. Accordingly, this course presents a number of frameworks that are critical for thinking about that which has not yet been invented.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

Grading/Final exam status: Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

Instructor: Ian I. Mitroff

ENGIN 183 Special Topics in Technology Innovation and Entrepreneurship 1 - 4 Units

Terms offered: Fall 2025, Summer 2025 First 6 Week Session, Spring 2025
This course will explore various topics around technology innovation and entrepreneurship. Topics will vary by semester.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

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: Engineering/Undergraduate

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

Formerly known as: Industrial Engin and Oper Research 190E

ENGIN 183A A. Richard Newton Lecture Series 1 Unit

Terms offered: Fall 2025, Spring 2025, Fall 2024
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.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Formerly known as: Industrial Engin and Oper Research 195

ENGIN 183B Berkeley Method of Entrepreneurship Bootcamp 2 Units

Terms offered: Fall 2025, Summer 2025 Second 6 Week Session, Spring 2025

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.

Rules & Requirements

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

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

Summer: 1 weeks - 30 hours of lecture and 20 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Formerly known as: Industrial Engin and Oper Research 192

ENGIN 183C Challenge Lab 4 Units

Terms offered: Fall 2025, Summer 2025 First 6 Week Session, Summer 2025 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.

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: Engineering/Undergraduate

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

Formerly known as: Industrial Engin and Oper Research 185

ENGIN 183D Product Management 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
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: Engineering/Undergraduate

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

Formerly known as: Industrial Engin and Oper Research 186

ENGIN 183E Technology Entrepreneurship 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
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).
Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Formerly known as: Industrial Engin and Oper Research 191

ENGIN C183F Challenge Lab: Building Bridges between Democracy and Technology for a Better Society 4 Units

Terms offered: Spring 2025
This experiential course prepares technical, business-minded, and policy-oriented students to build and plan the implementation of a product, startup, or policy innovation from scratch. This course is meant for students who seek a challenging, interactive, team-based, and hands-on learning experience in entrepreneurship and technology. Students can expect to work in an interdisciplinary team to develop novel products and solutions to address existing problems in the realm of democracy and technology.
Rules & Requirements

Repeat rules: Course may be repeated for credit with advisor consent.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Also listed as: POL SCI C193A

ENGIN 184 Writing Robots 4 Units

Terms offered: Spring 2025, Spring 2024
This writing-intensive course surveys and analyzes accounts of AI-generated
writing, while reflecting on the ramifications of AI for human writing practices. In other
words: how do we write about—as well as with—writing machines? How are emergent AI
writing technologies reshaping human writing cultures in STEM fields and beyond? How,
in turn, do accounts of and interactions with writing machines shape cultural conceptions
of human writers and thinkers, as well as technological frontiers for AI developers? What
does it mean to write for someone else, or to let someone or something else write for us?
How do preoccupations fundamental to all writing—audience, context, aims, and
aesthetics—shape both non-human and human writing?

Objectives & Outcomes

Course Objectives: To address these questions, we will analyze a broad range of texts framing these
questions, including chat transcripts, essays, and journal articles, alongside novels, plays,
and podcasts. Students will track and research a sub-topic of their choosing through a
cumulative series of summaries, essays, and opinion pieces, while chronicling their
developing writerly identities by reflecting on readings and assignments in a course
journal. At semester's end, they will revise and present a writing portfolio reflecting their
strongest work.

Student Learning Outcomes: By the end of this course, students will be able to
1) Analyze how technological developments are communicated to different audiences, and across different genres.
2) Identify, reframe, and synthesize representations of a particular technology.
3) Identify, synthesize, and analyze the media, interfaces, and methods by which a particular technology shapes its use and its users
4) Support arguments about technology and science-related topics using those identified and synthesized elements.
5) Develop and articulate a set of writerly practices, preferences, and beliefs in relation to writing in general, and automatic writing in particular.

Rules & Requirements

Prerequisites: Reading and Composition R1A and R1B

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 185 The Art of STEM Communication 3 Units

Terms offered: Summer 2025 First 6 Week Session, Summer 2024 Second 6 Week Session, Spring 2024
This course provides engineering majors with the fundamental skills for effective technical communication. During the course of the semester, students will develop communications for public dissemination, covering a project or initiative within UC Berkeley's College of Engineering. This work will call on students to: (a) cultivate interest in a broad range of topics related to Engineering; (b) become an engaged and critical reader of academic and general-interest science publications; (c) learn how to assess, plan for, and respond to a variety of communicative situations; (d) produce focused, and at the same time, narratively-rich, accounts of Engineering research.

Hours & Format

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

Summer: 6 weeks - 8-8 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

Grading/Final exam status: Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

ENGIN 187 Global Engineering: The Challenges of Globalization and Disruptive Innovation 1 or 2 Units

Terms offered: Fall 2019
The course examines the challenges of innovation beyond new technology development: from the challenges of global expansion, to the issues of unintended consequences of technology and the ability of technology to support or hinder social justice. The course will provide examples in a variety of global locations (e.g., Latin America, Southeast Asia, Africa, China, and India), utilizing case examples (written and presented by speakers) that illustrate the challenges faced in a range of fields of engineering and technology, from water and transportation to information and communications technology, and from start-ups to major corporations, government entities, and policy makers.

Rules & Requirements

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

Hours & Format

Fall and/or spring: 8 weeks - 2-4 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 188 Fung Fellowship Seminar: Health + Innovation 3 Units

Terms offered: Not yet offered
The Fung Fellowship: Health + Innovation course explores how design, innovation, and technology can address diverse health challenges. The course follows a typical design process from learning # focusing # building # testing. Whether you're an Engineering or English major, you will come away this semester with practical skills in human centered design: practical customer interviews, low-fidelity prototyping and better storytelling. My goal is that you gain skills to become the most effective person in the room after Cal. You will apply the concepts and skills to both individual and group-based design challenges. You will also work in small teams on a real-world design challenge and present your team's solution to a group of judges.

Objectives & Outcomes

Course Objectives: Communicate effectively using storytelling techniques.

Develop equity-centered problem-solving approaches
Engage in empathetic and human-centered research
Gain perspective on diverse public health and healthcare challenges
Generate potential solutions and their impact on public health
Identify and navigate challenges in diversity, bias, and team dynamics.
Implement effective work norms to support innovation.

Rules & Requirements

Prerequisites: Enrollment requires admission into the Fung Fellowship for Health + Innovation, which is restricted to UC Berkeley undergraduates in good standing in the fellowship program

Repeat rules: Course may be repeated for credit up to a total of 1 time.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Haddad

ENGIN 189 Fung Fellowship: Conservation and Sustainability 3 Units

Terms offered: Fall 2025
Welcome to the Fung Fellowship and welcome to the world of human centered design! This three-unit course is about compassionately looking at our world and the people in it to design solutions to pressing environmental and sustainability problems. Sometimes these solutions may be based in technology; other times they may be concerned with improving the ways human beings collaborate and work together. Students will acquire an expansive understanding of the notion of "design" and a theoretical foundation in thinking through complex ecological and social problems.You will learn about how problems are framed and how that determines our responses, understand the merits and limitations of tech-based solutions, and complete several design projects.

Objectives & Outcomes

Course Objectives: Be fluent in the many complex factors that influence current environmental conservation challenges (e.g., cultural, economic, and political).
Be well-versed in the merits and limitations of tech-based solutions.

Develop emotional and intellectual empathy for affected communities, and be able to translate that empathy into effective design.

Have a strong understanding of the principles of design thinking and human-centered design, its strengths and weaknesses.

Have experience formulating research questions, planning for and implementing multiple research methodologies (including surveys, interviews, and data analysis), ideation, and prototyping in concert with stakeholders/customers/collaborators.

Identify and better manage the challenges and opportunities associated with diversity, bias, and conflict within teams.
Understand design thinking applications in a wide variety of fields and professions including engineering, architecture, urban planning, art, community organizing, and development.
Use storytelling to communicate effectively with multiple audiences and for varied purposes.

Rules & Requirements

Prerequisites: Enrollment requires admission into the Fung Fellowship for Conservation/Sustainability track. Please visit fungfellows.berkeley.edu for the application details and timeline for Fall and Spring semesters. Undergraduates with junior and senior standings from all majors are eligible to apply for the fellowship

Repeat rules: Course may be repeated for credit up to a total of 1 time.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Young

ENGIN 194 Undergraduate Research 3 Units

Terms offered: Fall 2025, Summer 2025 10 Week Session, Spring 2025
Students who have completed a satisfactory number of advanced courses may pursue original research under the direction of one of the members of the staff. Final report and presentation required.

Rules & Requirements

Prerequisites: Consent of instructor and adviser, junior or senior standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 195A Engineering Science Senior Thesis Research 1 - 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Thesis work under the supervision of a faculty member. To obtain full credit, the student must submit a satisfactory thesis at the end of two semesters of research. A total of four units must be taken. The units must be distributed between the two semesters (2 units in E195A and 2 units in E195B, or 1+3 or 3+1). Note, completion of a senior thesis does not contribute toward graduation requirements.

Objectives & Outcomes

Course Objectives: Gain experience conducting an independent research project in science and/or engineering.
Report research outcomes in a written thesis.

Student Learning Outcomes: Develop familiarity reading scientific literature
Gain expertise in a field closely related to their coursework
Gain practice asking research questions and managing an independent project
Learn how to communicate scientific ideas and methods in a research thesis
Practice good teamwork with their fellow research students and their supervisor

Rules & Requirements

Prerequisites: Must be an Engineering Science student with senior standing, with one fall and one spring semester remaining, and an overall UC GPA of at least 3.3

Hours & Format

Fall and/or spring: 15 weeks - 3-9 hours of independent study per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 195B Engineering Science Senior Thesis Research 1 - 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Thesis work under the supervision of a faculty member. To obtain full credit, the student must submit a satisfactory thesis at the end of two semesters of research. A total of four units must be taken. The units must be distributed between the two semesters (2 units in E195A and 2 units in E195B, or 1+3 or 3+1). Note, completion of a senior thesis does not contribute toward graduation requirements.

Objectives & Outcomes

Course Objectives: Gain experience conducting an independent research project in science and/or engineering.
Report research outcomes in a written thesis.

Student Learning Outcomes: Develop familiarity reading scientific literature
Gain expertise in a field closely related to their coursework
Gain practice asking research questions and managing an independent project
Learn how to communicate scientific ideas and methods in a research thesis
Practice good teamwork with their fellow research students and their supervisor

Rules & Requirements

Prerequisites: ENGIN 195A

Hours & Format

Fall and/or spring: 15 weeks - 3-9 hours of independent study per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units

Terms offered: Fall 2025, Summer 2025 10 Week Session, Spring 2025
Group study of selected topics.

Rules & Requirements

Prerequisites: Upper division standing, plus particular courses to be specified by instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Summer: 8 weeks - 1.5-7.5 hours of directed group study per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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