Advanced Study in Engineering (MAS-E)

The Master of Advanced Study in Engineering (MAS-E) is an interdisciplinary, online professional degree program designed for busy working professionals who want to accelerate their careers by gaining state-of-the-art engineering knowledge and skills in a dynamic and engaging digital environment.

Students in this self-paced program have up to four years to complete the 24-unit degree. The MAS-E program is completed in 22 one-unit courses and a two-unit capstone project. The academically rigorous courses have pre-recorded lectures from Berkeley Engineering faculty, and all materials are available online and designed for self-paced study. The faculty members also provide live, virtual office hours throughout the semester.

The MAS-E degree program offers four interdisciplinary concentrations:

1. **Electronics and Systems Engineering**
2. **Advanced Manufacturing and Materials**
3. **Infrastructure, Energy, and the Environment**
4. **Robotics and Controls**

Students elect a concentration to focus their studies; each concentration has eight required courses. Students then choose 14 electives, and finish up with a 2-unit capstone course.

1. **Concentration (8 units)**: 8 required units specific to the concentration.
2. **Electives (14 units)**: 14 units from any part of the MAS-E course catalog.
3. **Interdisciplinary Capstone Project (2 units)**: Students will integrate cutting-edge knowledge and technical skills to address an interdisciplinary engineering challenge.

The College of Engineering also offers six other professional master's degrees (https://engineering.berkeley.edu/academics/graduate-programs/professional-masters-programs/), and an MS and Ph.D in eight different departments and disciplines (https://engineering.berkeley.edu/academics/graduate-programs/).

Admission to the Program

The Master of Advanced Study in Engineering (MAS-E) program is designed for both recent science or engineering graduates and individuals with several years of professional experience who are interested in gaining knowledge or skills for career growth.

The MAS-E degree is intended for those with a bachelor's degree in a STEM field, including but not limited to: Biology, Chemistry, Biochemistry, Engineering, Math, Physics, and Computer Science.

Pre-enrollment

The following requirements are important to succeed in MAS-E courses and should be met before enrollment. Students may fulfill these requirements after admission.

- Linear algebra & multivariable calculus
  - Some MAS-E courses require linear algebra and multivariable calculus as a prerequisite.
  - It is recommended to have coursework in these subjects, but motivated students without this coursework are allowed to self-study the relevant material.
- Programming experience
  - To succeed in MAS-E courses, you must have some prior experience programming in a high-level language such as Python, Java, or C/C++. Students should be familiar with variable assignments and control structure (for loops, if statements, logic) in one of these languages.
  - You can satisfy this requirement through prior coursework or through experience, or after admission.

Applying for Graduate Admission

Thank you for considering UC Berkeley for graduate study! UC Berkeley offers more than 120 graduate programs representing the breadth and depth of interdisciplinary scholarship. The Graduate Division hosts a complete list (https://grad.berkeley.edu/admissions/choosing-your-program/list/) of graduate academic programs, departments, degrees offered, and application deadlines can be found on the Graduate Division website.

Prospective students must submit an online application to be considered for admission, in addition to any supplemental materials specific to the program for which they are applying. The online application and steps to take to apply can be found on the Graduate Division website (https://grad.berkeley.edu/admissions/steps-to-apply/).

Admission Requirements

The minimum graduate admission requirements are:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A satisfactory scholastic average, usually a minimum grade-point average (GPA) of 3.0 (B) on a 4.0 scale; and
3. Enough undergraduate training to do graduate work in your chosen field.

For a list of requirements to complete your graduate application, please see the Graduate Division's Admissions Requirements page (https://grad.berkeley.edu/admissions/steps-to-apply/requirements/). It is also important to check with the program or department of interest, as they may have additional requirements specific to their program of study and degree. Department contact information can be found here (https://guide.berkeley.edu/archive/2024-25/graduate/degree-programs/).

Where to apply?

Visit the Berkeley Graduate Division application page (http://grad.berkeley.edu/admissions/apply/).

Length of Program

Students in this self-paced program have up to four years to complete the 24-unit degree, but they can finish in as few as two semesters if enrolled full-time.

Unit Requirements

The MAS-E degree requires: - 22 units of coursework; - A two-unit capstone project.

Interdisciplinary Themes

The MAS-E curriculum is organized into four interdisciplinary themes:

1. **Electronics and Systems Engineering**
2. **Advanced Manufacturing and Materials**
3. **Infrastructure, Energy, and the Environment**
4. **Robotics and Controls**

Students elect a concentration to focus their studies; each concentration has eight required courses. Students then choose 14 electives, and finish up with a 2-unit capstone course.

1. **Concentration (8 units)**: 8 required units specific to the concentration.
2. **Electives (14 units)**: 14 units from any part of the MAS-E course catalog.
3. **Interdisciplinary Capstone Project (2 units)**: Students will integrate cutting-edge knowledge and technical skills to address an interdisciplinary engineering challenge.

Advancing to Candidacy

Students must advance to candidacy prior to submission of the final capstone project.

Capstone

In the interdisciplinary Capstone project course, students will integrate learning from their technical courses to address an engineering challenge of their choosing. Through project, students will engineer solutions using cutting-edge technology and methods to address crucial industry, market, or societal needs.

The MAS-E program provides students with substantial technical expertise while also building their integrative and interdisciplinary skills.

The primary learning objectives for students of this degree are to:

1. Master methods of problem analysis and solving;
2. Deepen and expand their technical knowledge and skills;
3. Develop interdisciplinary expertise; and
4. Integrate and apply knowledge through their capstone project.

Graduates of the MAS-E program will be primed to advance their careers by:

- Learning the latest analytical methods in engineering;
- Building advanced skills in data science, artificial intelligence, machine learning, and more;
- Diving deep into an interdisciplinary engineering domain;
- Preparing for senior roles by studying subjects like technical leadership, innovation, digital transformation, and technology strategy.

By studying subjects in this program like engineering leadership, digital transformation, and technology strategy, you can qualify for senior technical and management roles as an electrical engineer, materials engineer, environmental engineer, and more. Berkeley Engineering graduates go on to work for employers such as Apple, Boeing, Google, Micron, Siemens and Tesla. Students can expect to participate in program-specific targeted workshops, individual career coaching and consultations, and networking opportunities.

The UC Berkeley Career Center (https://career.berkeley.edu) and the GradPro Professional Development (https://grad.berkeley.edu/professional-development/about-gpd/) program have an extensive on-campus recruiting program and numerous programs and workshops for engineering students. This includes special programs such as how to approach the job market, resume preparation, how to interview, along with providing opportunities to meet employers. Finally, you will be a member of a community of engineering leaders from different industries who will be your instant professional network as well as possible mentors, guiding you in your career journey.

Please note that the MAS-E program shares the "ENGIN" course code with other programs at UC Berkeley, and the list below is automatically populated for all ENGIN courses. For the most current list of courses available to MAS-E students, please visit our courses page here (https://mas-e.engineering.berkeley.edu/courses/).

ENGIN 200 Ethics, Engineering and Society 1 Unit

Terms offered: Prior to 2007
How can we identify and analyze ethical issues in engineering? How do we leave room for rapid and disruptive innovation while responsibly considering the impact of technology on society and identifying the new ethical challenges that arise? This course provides an introduction to how theories, concepts, and methods from the humanities and social science can be applied to ethical problems in engineering.

Objectives & Outcomes

Course Objectives:
Apply theoretical and conceptual tools from the humanities and social sciences to engineering problems

Assess and direct one's own learning
Engage in peer review
Identify and analyze ethical issues in science and engineering.

Lead and contribute to ethics discussions with fellow students, using asynchronous platforms such as Piazza
Understand professional responsibilities

Student Learning Outcomes: Better understand your own values, and how they #t in your understanding of engineering, ethics and society.
Empowered to engage others in conversation about ethics, and engineering and society, and to identify ethical issues when they may arise.
Familiar with engineering professional responsibilities (e.g. passive and active responsibilities, role responsibilities, work within bounds of knowledge etc).
Understand the relationship among risk analysis, design, risk communication, stakeholder engagement, community building, value-sensitive design.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld or other training or work experience related to the practice of engineering

Credit Restrictions: Students will receive no credit for ENGIN 200 after completing ENGIN 200. A deficient grade in ENGIN 200 may be removed by taking ENGIN 200.

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Scarlat

ENGIN 201 Graduate Ocean Engineering Seminar 2 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Lectures on new developments in ocean, offshore, and arctic engineering.

Objectives & Outcomes

Course Objectives: To provide exposure of the field of ocean engineering, arctic engineering and related subject areas to students at graduate level with intention to show the broad and interdisciplinary nature of this field, particularly recent or new developments.

Student Learning Outcomes: Students will learn of new developments in ocean, offshore, and arctic engineering, connecting much of what is learned in other courses to practical applications and active research topics.

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructors: Makiharju, Alam

ENGIN 202A Human Centered Design Methods I 1 Unit

Terms offered: Prior to 2007
This course provides an introduction to design methods used in the development of innovative and realistic customer-driven engineered products, services, and systems. Design methods and tools are introduced and the student's design ability is developed via a series of short design process modules: design research, analysis and synthesis, concept generation and creativity. Students will be expected to use tools and methods of professional practice to consider the social, economic and environmental implications of their products, services, or systems. There is an emphasis on hands-on innovative thinking and professional practice.

Objectives & Outcomes

Course Objectives: The goal of this course is to provide an introduction to design methods used in the development of innovative and realistic customer-driven engineered products, services, and systems.

Student Learning Outcomes: Students will be expected to use tools and methods of professional practice to consider the social, economic and environmental implications of their products, services, or systems.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld (engineering or physical science) OR prior experience with the engineering design process or innovation process in business, architecture, or engineering (e.g., ARCH 11A or UGBA C5.)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Goucher-Lambert

ENGIN 203 Designing for the Human Body 1 Unit

Terms offered: Fall 2025, Fall 2024
Students will learn how the body transfers loads during daily activities and how external or internal device design can have a long-term impact on body bio-mechanical function. Some examples include the impact of phone use and forward flexion of the neck and asymmetrical spinal loading due to shoulder bags (e.g., impact on factory workers or military personnel). The role of human-centered design on internal and external devices will be presented through case studies. Lastly, the impact of data from novel portable measurement tools that can be incorporated into wearable devices will be discussed, with a specific focus on disease monitoring, prevention, and early detection.

Objectives & Outcomes

Course Objectives:
The main goal of this course is to present how external or internal device design can have a long-term impact on body biomechanical function and the role of human-centered design on internal and external devices.

Student Learning Outcomes: Students will learn how the body transfers loads during daily activities and how external or internal device design can have a long-term impact on body bio-mechanical function.

Rules & Requirements

Prerequisites: *Undergraduate degree in a STEM field. Prerequisites (op#onal): hands-on skills (e.g., making 3D models), physics, engineering materials course, engineering design

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: O'Connell

Formerly known as: Engineering 202B

ENGIN 204A The digital transformation in industry 1 Unit

Terms offered: Prior to 2007

The purpose of this course is to make the student fluent with the context, concepts and key content of the technologies that are driving what is collectively known as “Digital Transformation” (DT), and more specifically, focus on the industrial impact of DT, as captured under the term “Industry 4.0” (I4.0). This topic is quite important: for millennia we have improved our circumstances by managing our material surroundings: tools, shelter, supplies, land. Access to information is meant to enhance our efficiency in doing so, and dwindling resources, impeding climate change, and geopolitical strife are now stressing our planet. This will be an engineering course taught in the context of sociology, economics and geopolitics.

Objectives & Outcomes

Course Objectives: The objective is to provide an in-depth introduction to the major Information technology advances
and tools that are impacting industry.

Student Learning Outcomes: The purpose of this course is to make the student fluent with the context, concepts and key content of the technologies that are driving what is collectively known as “Digital Transformation” (DT), and more specifically, focus on the industrial impact of DT, as captured under the term “Industry 4.0” (I4.0).

Rules & Requirements

Prerequisites: Prerequisites* *Undergraduate degree in a STEM field

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Spanos

ENGIN 204B The Flow of Power, Information and Money in Tomorrow's Smart Grid 1 Unit

Terms offered: Prior to 2007

We begin by surveying the electricity grid landscape: smart metering, renewables, flexible loads, electric vehicles, storage, and innovative tariffs.. We introduce energy economics with a focus on electricity markets, consumer and producer behavior. We then analyze the problems that deep renewable integration poses for grid operations and reliability. We explore demand response from distributed resources to enable cost-effective renewable integration. Tomorrow’s grid will have an intelligent periphery. We will explore the architectural and algorithmic components for managing this intelligent periphery for flexible load management. "We then describe a vision for Grid2050 where electricity delivery evolves into interconnected micro-grids."

Objectives & Outcomes

Course Objectives: The course will survey the changing landscape of electricity grids, from the basics of electrical grids, the integration of renewable sources through the use of demand response from distributed sources, and to the elements of tomorrow's smart grids using interconnected micro-grids.

Student Learning Outcomes: A comprehensive understanding of (a) central ideas in electricity grids including power flow, state estimation, sensing and actuation in smart grids, (b) electricity markets, locational prices, demand response, models for storage and renewables, (c) policy choices for energy efficiency, pricing of distributed energy resources, and novel market instruments to manage risk and variability.

Rules & Requirements

Prerequisites: 1. Basic complex arithmetic: rectangular and polar coordinates, magnitude, phase, products, ratios. Drawn from any high-school course on complex arithmetic. 2. Basic linear algebra: matrices, vectors, linear equations, inverses, determinants. For example: EECS16A or Math 54. 3. Basic electric circuits: voltage, current, Kirchoff’s current and voltage laws, solving resistive circuits, power, inductors and capacitors. For example: EECS16A or ME 100

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Poolla

ENGIN 210A Renewable Energy Systems 1 Unit

Terms offered: Prior to 2007
This is an engineering introduction to renewable energy technologies and potentials. The course aims to introduce a general engineering/science audience to the basic concepts of renewable energy. Topics to be covered include Solar Energy, Ocean Energy, Wind Energy, and Geothermal Energy. Some mathematical criteria will be covered, e.g. Betz limit for wind, limit of WEC point absorber. Each lecture contains several examples from real world applications and in-progress industrial developments.

Objectives & Outcomes

Course Objectives: To give a big-picture technical overview of di#erent types of renewable energy resources, technologies and opportunities, with the goal of being able to make informed decisions in industry and the government.

Student Learning Outcomes: Graduates of this course should be able to identify the pros and cons of each resource and technology, and to be able to make quantitative and qualitative assessments of the performance of each idea for a given environment.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. As well, minimum prerequisite requirements are: Math 53 (Multivariable Calculus) or equivalent Math 54 (Linear Algebra & Di#erential Equations) or equivalent Physics 7A, 7B (Physics for Scientists and Engineers) or equivalent ENGIN 7 (Introduction to Programming for Scientists and Engineers) or equivalent

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Alam

ENGIN 210B Engineering a Net-Zero Carbon Future 1 Unit

Terms offered: Fall 2025, Fall 2024
Climate change is arguably the preeminent issue of our time. The transition to a clean energy society can help avoid the worst impacts of climate change. The energy systems engineer's role is to deeply understand the challenges and develop creative technical solutions. This course provides students with an introduction to the technical fundamentals of clean energy challenges and opportunities. Challenges include urbanization, renewable energy integration, and sectors that are di#cult to decarbonize. Opportunities include clean energy generation technologies, energy storage, microgrids, and electri#ed transportation.

Objectives & Outcomes

Course Objectives: This course focuses on the challenges facing a clean energy transition from the perspective of engineering, science, technology, and economics. Contents include climate change trends, electricity production, transportation, industrial processes, buildings, microgrids, renewables, economics and equity. The emphasis is on connecting technological concepts with scienti#c fundamentals. More speci#cally, the course examines the mathematics and physics of energy systems. Upon completion, students will be able to design and analyze energy system solutions, such as solar/wind/storage systems, microgrids, electri#ed transportation systems, net-zero buildings, and more.

Student Learning Outcomes: 1.
Knowledge of anthropomorphic trends that motivate a clean energy transition
2.
A fundamental understanding of the scienti#c principles underlying several key clean energy technologies
3.
An ability to understand and communicate about clean energy systems.

Rules & Requirements

Prerequisites: MATH 51 and MATH 52; PHYSICS 7A or PHYSICS 8A; PHYSICS 7B or PHYSICS 8B; and CHEM 1A

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Moura

ENGIN 211A Nexus of Water, Land and Energy in a Sustainable World 1 Unit

Terms offered: Prior to 2007
Are we running out of energy, land and water? Although the total land area and the volume of water remain constant, their use is under pressure. Energy consumption also increases. Growing population, increasing demand for food, expanding cities, quest for energy, industrialization, and irrational policy are all contributing towards global and local stresses. We will explore the challenges to the availability of water, energy and land as well as potential solutions to the impending crises. We will discuss new technologies for water management, energy production and consumption, and land stewardship. Case studies related to the developing water-land-energy nexus will be presented.
Objectives & Outcomes

Course Objectives: The goal of the course is to explore the challenges to the availability of water, energy and land as well as potential solutions to the impending crisis. Selected applications in various disciplines and economic sectors will be discussed. The course will introduce several mathematical and physical concepts related to system dynamics and sustainability and combine them with normative tenets of ethical behavior. These will be examined in a rigorous way but with emphasis on understanding these concepts rather than on technical details.

Student Learning Outcomes: Ability to formulate and analyze sustainability actions and plans within the three-part framework (Sustainability sphere, time horizon, metrics) and understanding physical and chemical underpinnings of sustainable development.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Lower division physics (Physics 7A and 7B or equivalent), basic chemistry (Chem 1A or equivalent)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Hermanowicz

ENGIN 211B Manufacturing in a Climate Emergency 1 Unit

Terms offered: Prior to 2007
The current rapid evolution of manufacturing technology is reshaping where, when, & by whom objects are produced. The emergence of increasingly sophisticated additive manufacturing processes, coupled w/greater automation, mean that mass customization, decentralized production & more complex geometries & material combinations are more attainable than ever before. Environmental impacts of these new ways of transforming material are challenging to quantify and subject to wide range of di#ering opinions & assumptions. This course provides participants w/framework for critically analyzing new processing routes, so decisions are made with a clearer view of their implications for energy consumption, recyclability & consumption of finite resources.
Objectives & Outcomes

Course Objectives: The main goal of the course is to provide an overview of the impacts of di#erent material and manufacturing process choices and methods of analyzing the impact of a new processing route, which can inform decisions based on a clearer view of their implications for energy consumption, recyclability, and consumption of #nite resources.

Student Learning Outcomes: In this course, students will gain a framework for critically analyzing new processing routes, so that decisions can be made with a clearer view of their implications for energy consumption, recyclability, and consumption of #nite resources.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. The speci#c prerequisites are as follows: introductory undergraduate-level physics, chemistry and math, and an introductory undergraduate materials science or mechanics of materials class, or equivalent. These courses at UC Berkeley or their equivalent would satisfy the prerequisites: Phys 7A & 7B, Chem 1A, Math 53, and MEC ENG C85 or Engin 45

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Taylor

ENGIN 212 The Physics of Water-Enabled Technology 1 Unit

Terms offered: Not yet offered
The physics of water #ow is an enabling element in technologies both new & old. The physics concepts are straightforward, but require careful treatment to get meaningful results about water #ow. This is because water shows patterns that emerge from the sum of many small motions and are not predicted easily The challenge for a working engineer or manager is knowing when “emergent” patterns can be reliably extrapolated from one system from another, when they can be controlled, and how they connect to the laws of physics when a “sanity check” is needed. This course examines key principles in water physics through a lens of contemporary technology including membranes, turbines, #ow cytometers, treatment ponds, gas exchangers & atomizers.

Objectives & Outcomes

Course Objectives: This course will enable students to understand the fundamental principles and evaluate the engineering feasibility of contemporary and future technology that relies heavily on the physics of water #ow. Application areas for the technology include: energy storage, generation, and transmission; material processing and separation; environmental and climate dynamics. Key concepts include: turbulence, boundary layers, suspension #ows, and solute transport.

Student Learning Outcomes: Students will be able to follow and critically evaluate technology proposals that rely on #uid mechanics. Students will be able to calculate the limits and end-members of the most common #uid engineering processes (e.g. mixing, thrust, drag, and resuspension). Students will be able to take a multi-faceted #ow problem and rewrite it as a series of linked elements, each one with a known #uid-mechanical nomenclature and standard solution method.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Recommended additional prerequisites: mastery of algebra, #uency with calculus, #uency with data plotting and #tting including uncertainty. Speci#c Berkeley classes that meet the recommended additional prerequisites: MATH 51, MATH 52, PHYSICS 7A, DATA C8

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Variano

ENGIN 215A Nuclear Energy and the Environment 1 Unit

Terms offered: Spring 2025
Electricity production from nuclear energy is highly concentrated and free of green-house
gasses. The pressure to decarbonize electricity generation is leading many to think of nuclear
as a near term solution. Nevertheless, public opinion remains in general skeptical of nuclear.
This course aims to familiarize students with nuclear energy, the way it is produced, and its
overall environmental impact. The course will cover fundamental characteristics of nuclear
energy, will provide students with a practical understanding of nuclear reactors, and will review
the benefits and the challenges that nuclear energy can provide.

Objectives & Outcomes

Course Objectives: This course aims to familiarize students with nuclear energy, the way it is produced, and its overall environmental impact.

Student Learning Outcomes: - Students will learn to evaluate the multiple ways different sources of energy impact the
environment
- Students will understand the main features of nuclear energy, its benefits and its challenges
- Students will be able to understand and explain the basic features of new nuclear
technologies

Rules & Requirements

Prerequisites: STEM undergraduate degree. Also, students should have a basic understanding of the atomic structure and basic knowledge of heat transfer mechanisms

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Fratoni

ENGIN 216B Soil Liquefaction 101: Triggering, Consequences and Mitigation 1 Unit

Terms offered: Spring 2025
One of the leading causes of damage during earthquakes is soil liquefaction. It can have devastating consequences on critical infrastructure such as dams, ports and other lifelines. This course will serve as an introduction to the phenomenon of soil liquefaction, as well as details on simpli#ed and advanced methods of analyses. Speci#cally, this phenomenon will be presented, as well as empirical and mechanistic methods to determine soil liquefaction triggering and post-liquefaction strength loss and its consequences for a range of materials (gravels, sands and silty soils). Laboratory and #eld testing to collect data that helps determine liquefaction triggering and post-liquefaction soil behavior (e.g. strength loss, dilation and hardening)
Objectives & Outcomes

Course Objectives: 1.
To introduce the phenomenon of soil liquefaction and develop an understanding of the factors contributing to soil liquefaction susceptibility.
2.
To familiarize students with laboratory and #eld tests that can be used to determine liquefaction vulnerability.
3.
To teach students about available simpli#ed and advanced methods for conducting liquefaction triggering analyses.
4.
To introduce concepts of post-liquefaction soil response and teach students methods for estimating post-liquefaction strength and settlement potential.
5.
To discuss state of the art methods for advanced dynamic numerical modeling of pore pressure generation during seismic shaking
6.
To introduce mitigation techniques for soil liquefaction.

Student Learning Outcomes: 1.
Given certain soil characteristics such as grain size distribution, and plasticity, determine whether the soil is susceptible to soil liquefaction.
2.
Given intensity of shaking, soil characteristics and results from #eld tests, determine whether the soil will liquefy (deterministic approach), or the probability that the soil will liquefy (probabilistic approach).
3.
Interpretation of laboratory data from cyclic loading tests on lique#able soils.
4.
Given shaking intensity, soil characteristics/properties, determine what the post-liquefaction and/or volumetric strain potential is.
5.
Given soil characteristics and type of a#ected infrastructure, select appropriate mitigation measures.

Rules & Requirements

Prerequisites: The prerequisites (or their equivalents) are as follows: Math 1A and 1B OR Math 16A or 16B; Physics 7A OR Physics 8A; CivEng C30/MecEng C85 and CivEng 175

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

ENGIN 217B Principles of Modern Ocean Engineering 1 Unit

Terms offered: Spring 2025
Ocean Engineering is gaining a renewed flood of attention as energy companies (oil, mining,
renewables) eagerly look for extra resources in the oceans, entailing concerns about the
environment and the planet. This course intends to introduce the basics of engineering
principles for working in the area of ocean engineering. Specifically, topics of wave dynamics,
wave, wind and current loads on ocean structures, and cables and mooring are covered. Each
lecture is accompanied with examples from real-life problems, and for each subject a review of
state of the art applications is provided through videos and presentations.
Objectives & Outcomes

Course Objectives: To develop a fundamental understanding of how ocean objects (ships and offshore structures) work as they interact with the ocean environment, and to be able to make engineering designand estimations of forces and loads.

Student Learning Outcomes: By the end of this course, students should be able to identify and explain different forcing factors for vehicles, structures and objects in the ocean, and to be able to estimate the forces and moments on those items.

Rules & Requirements

Prerequisites: Undergrad. degree in STEM field. Basic knowledge of undergraduate-level math (particularly differential equations) necessary. We derive all equations from basic principles and therefore students should be able to follow. Following subjects are highly recommended as prerequistes for this course: Undergrad. level Mathematics (include Differential Equations, e.g. Math 54 or equivalent) Undergrad. Fluid Mechanics (ME106 or equivalent) Undergrad. Solid Mechanics (ME C85,CE C30 or equivalent)

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Alam

ENGIN 218 Wildland Fire Engineering 1 Unit

Terms offered: Spring 2025

Wildland fires are both a natural part of Earth's ecosystem and a destructive force that devastates people and the environment. This course will present an introduction to the global problem of wildland fire starting with the drivers of destructive wildfire: fire exclusion, expansion in the wildland-urban interface (WUI), and climate change. The basic phenomena that control wildland fires including, ignition, fire spread, suppression, crown fires, smoke generation, hazard and risk analysis, the interplay with fire ecology, etc. will be covered. A specific focus of the course will be on the science, technology and applications engineers use to predict, prevent, detect, and suppress wildland fires.

Objectives & Outcomes

Course Objectives: The course objectives are to provide students with the knowledge necessary to work within the highly interdisciplinary field of wildland fire, including a broad understanding of the social, ecological, and economic factors influencing wildland fire, a firm understanding of the underlying mechanisms affecting wildland fire spread, and an ability to apply the tools necessary to predict the spread rate and intensity of wildland fires and assess protection of WUI communities.

Student Learning Outcomes: After completing this course, students will have an entirely new perspective on the problem of wildland fire and a new breadth of tools to apply to risk analyses, suppression, and to mitigate the effect of wildfires on communities.
Assess protection of WUI communities
Know some environmental, ecological, social, economic and political factors affecting the field
Knowing the major problems affecting the field of wildland fire
Predict the spread rate and intensity of wildland fires
Understand the underlying mechanisms driving wildland fires

Rules & Requirements

Prerequisites: MATH 51, 52, and MATH 53

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Michael Gollner

ENGIN 222 Molecular imaging methods for R&D and clinical trials of emerging molecular therapies 1 Unit

Terms offered: Prior to 2007

This course is designed as an introduction to the growing world of molecular imaging in medicine and research. The current con#uence of increased understanding of how genetic di#erences mitigate drug response, alongside substantial innovation in targeted molecular therapeutics including gene editing approaches, represents an in#ection point for the use of molecular imaging.
This course will provide individuals with fundamental understandings of medical imaging modalities that are used in both R&D and clinical settings. Building upon this framework, corresponding methods for targeted molecular imaging including contrast mechanisms and probe design will provide direct relevance to current needs for high throughput in vivo e#cacy measurements

Objectives & Outcomes

Course Objectives:
Discuss the design of targeted molecular contrast agents for each modality across myriad biological applications
Establish a foundational understanding of MRI (multi-spectral), PET/SPECT, Ultrasound (including photo-acoustic imaging), and emerging methods including MPI
To expose students interested in biomedical research or clinical practice to fundamentals of modern imaging methods and interpretation
To learn quantitative approaches to analyze biomedical images (includes pharmacokinetic models, attenuation correction, cross modality registration, etc.)

Student Learning Outcomes: This course will provide individuals with fundamental understandings of medical imaging modalities that are used in both R&D and clinical settings. Building upon this framework, corresponding methods for targeted molecular imaging including contrast mechanisms and probe design will provide direct relevance to current needs for high throughput in vivo e#cacy measurements. Quantitative methods for image analysis will be taught in the context of real world disease targeted applications using published data from recent clinical trials.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld and skills/knowledge equivalent to what is covered in UCB Math 53 & 54, EE16A, Physics 7A&7B, Bio1A, MCB 32

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Vandsburger

ENGIN 223 Radiopharmaceuticals: From the Basics to the Patients 1 Unit

Terms offered: Prior to 2007
This is an introductory course to the science behind radiopharmaceutical development and use.It will also cover emerging topics in the field, including new exciting methods for disease treatment and diagnosis. The course is tailored to a broad audience.

Objectives & Outcomes

Course Objectives: Describe processes involved in using medical isotope for diagnostic and therapeutic applications, including isotope production, radiolabeling, pharmaceutical agent development, clinical use, and regulations.
Introduce students to medical isotopes.
Introduce students to physical, chemical and biological effects of radiation on humans and tissue. Describe radiation damage to DNA in a cellular environment.
Provide an overview of state-of-the-art radiopharmaceutical agents available today.
Provide students with background in the basic physical and biological factors governing
radiation effects in man.
Introduce students to mechanisms by which radiation interacts with matter.

Student Learning Outcomes: Students in this course will gain a background in the science behind radiopharmaceutical development and use.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field. The following prerequisite courses or their equivalent are recommended: BIO ENG 10; and BIO ENG 11 or BIOLOGY 1A; PHYSICS 7A & 7B; and MATH 54

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Abergel

ENGIN 224B Introduction to Neurophysiology 1 Unit

Terms offered: Prior to 2007
The brain is the most spectacular yet most mysterious organ in our body. It controls every action we make, determines who we are and exceeds in its capacity any existing computer. The course will provide students with a detailed description of the basic principles of brain function, i.e., neurophysiology. The course will start from the cellular resolution and expand into a systems-wide view (such as vision, auditory, motor, memory systems) while underscoring shared neurophysiological principles. Furthermore, the course will provide students with real-life examples of clinical conditions that are associated with malfunctions in those systems as well as examples of solutions that were derived to treat physiological deficits in them.

Objectives & Outcomes

Course Objectives: The course will provide students with a detailed description of the basic principles of brain function, i.e., neurophysiology.

Student Learning Outcomes: Students will learn the basic principles of brain function starting from the cellular resolution and expanding into a systems-wide view.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field. The following prerequisite courses or their equivalent are recommended: BIO ENG 10 ; and BIO ENG 11 or BIOLOGY 1A ; and MATH 54

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Yartsev

ENGIN 230 Methods of Applied Mathematics 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
Topics include complex variable methods, contour integration, solution of Laplace's equation via analytic function theory; asymptotic methods for evaluating integrals and solving differential equations; introduction to calculus of variations with applications; introductory integral equations. The course is intended to expose students in engineering and physical sciences to a range of methods for solving equations associated with mathematical models of physical processes.

Rules & Requirements

Prerequisites: MATH 54 or equivalent. ENGIN 117 or equivalent is desirable but not mandatory

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Steigmann

ENGIN 231 Mathematical Methods in Engineering 3 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017
This course offers an integrated treatment of three topics essential to modern engineering: linear algebra, random processes, and optimization. These topics will be covered more rapidly than in separate undergraduate courses covering the same material, and will draw on engineering examples for motivation. The stress will be on proofs and computational aspects will also be highlighted. It is intended for engineering students whose research focus has a significant mathematical component, but who have not previously had a thorough exposure to these topics.

Rules & Requirements

Prerequisites: MATH 51, MATH 52, MATH 53, and MATH 54 (or equivalent coursework)

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Packard, Poolla

ENGIN 232 Fundamental Data Structures 1 Unit

Terms offered: Prior to 2007
In this course, Fundamental Data Structures, students will learn about the foundational data structures used by almost all programming languages. Rather than simply presenting these data structures as fait accompli, we will start from scratch, working together to develop the beautiful and important ideas that result. The course assumes familiarity with the Java Programming language, which is covered in the course ENGIN 234 “Introduction to Java and Software Engineering.”

Objectives & Outcomes

Course Objectives: In this course we will learn several di#erent approaches to solving canonical CS problems. We will also learn to study the asymptotic runtime and space complexity of these approaches.

Student Learning Outcomes: After taking this course, students will better understand how to take big complex problems and break them down into digestible subproblems. Students will understand how to analyze the e#ciency of their solutions to computational problems. Students will understand some of the most important data structures in computing. Students will understand how an abstract data type can be implemented with many di#erent concrete approaches.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Students need to be familiar with the Java programming language and linked lists. This prerequisite knowledge is covered in ENGIN 234 - Introduction to Java and Software Engineering

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Hug

ENGIN 233 Making Sense of Data: Introduction to Statistical Inference 1 Unit

Terms offered: Not yet offered
We are often presented with a set of data, often very large, about various processes or phenomena (health data, economic performance, environmental indices, experimental observations). How do we make sense of them? We will describe various statistical tools that will allow us to draw meaningful conclusions (inference). Topics covered include various distribution functions and criteria for their selection (goodness of fit), descriptive statistics compressing the data, estimation of various parameters from the data, measures of relationships between different datasets (correlation, regression), and data related in time (time series).

Objectives & Outcomes

Course Objectives: To enable students to draw conclusions from a set of data using statistical methods.

Student Learning Outcomes: Knowledge of how to use statistical techniques, appreciate their assumptions and fundamentals, and to recognize their misuse.

Rules & Requirements

Prerequisites: Calculus (MATH 51 and MATH 52 or the equivalents). An undergraduate degree in a STEM field is preferred

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Hermanowicz

Formerly known as: Engineering 236

ENGIN C233 Applications of Parallel Computers 3 - 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023, Spring 2022, Spring 2021
Models for parallel programming. Overview of parallelism in scientific applications and study of parallel algorithms for linear algebra, particles, meshes, sorting, FFT, graphs, machine learning, etc. Survey of parallel machines and machine structures. Programming shared- and distributed-memory parallel computers, GPUs, and cloud platforms. Parallel programming languages, compilers, libraries and toolboxes. Data partitioning techniques. Techniques for synchronization and load balancing. Detailed study and algorithm/program development of medium sized applications.

Rules & Requirements

Prerequisites: No formal pre-requisites. Prior programming experience with a low-level language such as C, C++, or Fortran is recommended but not required. CS C267 is intended to be useful for students from many departments and with different backgrounds, although we will assume reasonable programming skills in a conventional (non-parallel) language, as well as enough mathematical skills to understand the problems and algorithmic solutions presented

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

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Demmel, Yelick

Also listed as: COMPSCI C267

ENGIN 234 Introduction to Data Structures and Software Engineering 1 Unit

Terms offered: Spring 2025
The Introduction to Java and Software Engineering course provides important principles and
techniques that you can use to minimize overall development and maintenance time when
writing computer programs. To that end, we introduce the Java programming language, a widely used programming language that supports these best practices, though these practices can be applied in other languages as well. The course assumes familiarity with at least one programming language, not necessarily Java.

Objectives & Outcomes

Course Objectives: This course will begin by introducing the Java programming language and tools for compiling and running Java programs. We will then introduce some essential software engineering practices in the context of implementing linked lists and array lists.

Student Learning Outcomes: After completing the course, students will have a basic familiarity with Java, an understanding of basic software engineering practices and how Java supports them, and how lists can be implemented in many different ways.

Rules & Requirements

Prerequisites: Prior experience with any programming language, not necessarily Java. Students should be comfortable with recursion. Experience with object oriented programming is encouraged, but not required. Example courses that satisfy this requirement: COMPSCI 61A, COMPSCI 88, and ENGIN 7

Credit Restrictions: Students will receive no credit for ENGIN 234 after completing COMPSCI 61B. A deficient grade in ENGIN 234 may be removed by taking COMPSCI 61B.

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Hug

ENGIN 235A Python for Engineers 1 Unit

Terms offered: Summer 2025
In recent years Python has emerged as an indispensable programming language for engineers, both practicing and academic, as well as data scientists, web developers, and many others. However the language is vast and includes many features that are not relevant to most engineers. This course helps students to quickly gain a foothold with the parts of the language that they are most likely to use. We will set up our programming environment with Anaconda, Jupyter, and PyCharm. We will learn the basic data types and syntax of the language, and then delve into its most popular numerical packages: Numpy, SciPy, and Pandas. The course includes many demonstrations of the concepts, and sample visualizations created with Matplotlib.

Objectives & Outcomes

Course Objectives: The goal of this course is to help students to quickly gain a foothold with the parts of the language that they are most likely to use.

Student Learning Outcomes: Learn basic Python syntax.
Learn how to navigate the Python universe, including #nding and installing new libraries, and overcoming programming obstacles.
Learn to solve engineering problems using Python

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Students who take this course should have a basic understanding of linear algebra and ordinary di#erential equations (e.g. Math 54). They should also be familiar with the basic concepts of probability and statistics: random variables, Gaussian distribution, up to linear regression (e.g. STAT 2)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Gomes

ENGIN 236A Applied Data Science for Engineers 1 Unit

Terms offered: Prior to 2007
This course aims at providing basics of Data Science to students and professionals who need to work with and analyze a large volume of data. The base programming language is Matlab, but techniques taught, and topics covered can be coded in any programming language (examples from Python and Fortran will be discussed). The course is aimed at graduate students in engineering, and therefore examples, assignments and the course project are from real life scenarios and engineering problems.
Objectives & Outcomes

Course Objectives: The objective is to provide the students with a set of important tools that are necessary in analyzing large data. This course is designed for those with little programming experience or background in data science.

Student Learning Outcomes: By the end of this course students should be able to handle, analyze and interpret a large volume of data associated with a speci#c problem. The examples are given from the engineering and physical world (oceans, atmosphere, machines). The expected outcome is to make sense of a large data set, identifying features, prediction of the future state of the system, and performing optimization.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Speci#cally required courses (or their equivalent) follow below: Math 53 (Multivariable Calculus) or equivalent Math 54 (Linear Algebra & Di#erential Equations) or equivalent Physics 7A and Physics 7B (Physics for Scientists and Engineers) or equivalent ENGIN 7(Introduction to Programming for Scientists and Engineers) or equivalent

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Alam

ENGIN 236B Data Science and Machine Learning Fundamentals 1 Unit

Terms offered: Summer 2025
The Data Science and Machine Learning Fundamentals course provides an introduction to machine learning in the context of data science. By the end of the course, students will know how to clean, visualize, and model real world datasets using basic machine learning techniques. The course assumes a familiarity with the Python programming language.
Objectives & Outcomes

Course Objectives: Early in the course, we will explore how linear models can be used to solve two of the most important problems in machine learning: Regression and Classi#cation. Along the way, we will learn some important concepts that allow us to avoid over#tting in our models. At the end of the course, we will discuss some practical skills for using and visualizing real world datasets.

Student Learning Outcomes: After the course, students will be able to model and understand real world data and tell insightful and accurate stories about what they discover.

Rules & Requirements

Prerequisites: Undergraduate degree in STEM #eld. Students should have basic familiarity with Python (e.g. COMPSCI 61A, COMPSCI 88 or the equivalent) and linear algebra (e.g. Math 54 or the equivalent). Experience with NUMPY recommended, but not required

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Hug

ENGIN 237A An Introduction to the Basics of Machine Learning 1 Unit

Terms offered: Prior to 2007
This course will introduce linear algebra, and cover some fundamental algorithms in machine learning including least squares, orthogonal matching pursuit and ridge regression. We will talk about the concepts of validation and testing. This is not intended to be an advanced machine learning course, but more a mathematical course to build out the basic background.

Objectives & Outcomes

Course Objectives: The course objectives are to give students the #rm grounding in linear algebra that is necessary as a foundation for any machine learning work.

Student Learning Outcomes: Students will be able to understand the fundamentals of linear algebra and have exposure to the basic/most commonly used machine learning techniques from a mathematical perspective.

Rules & Requirements

Prerequisites: The course prerequisites are skills in calculus and trigonometry, equivalent to Math 1A

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Ranade

ENGIN 238B Optimization Theory and Practice 1 Unit

Terms offered: Prior to 2007
Optimization theory concerns the selection of a best option from a set of available options. Formulating an optimization problem involves describing the feasible set as well as prescribing a notion of “best”. This setup, although simple, is one of the most important and widespread ideas in engineering and the sciences. The course will begin by demonstrating the use of optimization theory in many contexts. Then, the second module of the course will delve into the class of tractable “convex” problems. In the third module we willreview more advanced topics, including optimal control and solving non-convex problems with algorithms.

Objectives & Outcomes

Course Objectives: The main goal of this course is to demonstrate the use of optimization theory in many contexts where the students will learn the standard categorization of optimization problems, and the mathematical and numerical tools available in each category. These will be applied to applications in the real world.

Student Learning Outcomes: Students will learn to formulate decision problems from the real world as mathematical optimization problems, To classify these problems and select an appropriate solution technique To solve the problems with a computer program.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Also, prerequisites include Math 53, Math 54, Physics 7A, and Physics 7B or their equivalents). In addition, prerequisites include programming (e.g. ENGIN 7 and ENGIN 177 or their equivalents)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Gomes

ENGIN 238C Optimization of Engineering Systems 1 Unit

Terms offered: Spring 2025

Optimization is a fascinating topic that #nds applications across a wide array of disciplines, including #nance, energy, data science, physical sciences, public policy, social science, and more. After completing the course, students will have an entirely new perspective on designing systems using mathematical optimization. Speci#cally, this course provides students with an introduction to mathematical optimization from the point-of-view of data science applications,
e.g. mobility, energy, #nance. Foundational concepts include optimization formulations, linear programming, quadratic programming, convex optimization, and machine learning.

Objectives & Outcomes

Course Objectives: This course is designed to provide students with an introduction to mathematical optimization from the point-of-view of data science applications, e.g. mobility, energy, #nance.

Student Learning Outcomes: After completing this course, students will have an entirely new perspective on designing systems using mathematical optimization.
Learn to abstract practical engineering design problems into mathematical optimization programs
Construct a foundation for the fundamental principles of optimization, including objective functions vs. constraints, linear, nonlinear, and convex formulations, gradient-based methods vs. non-gradient based methods, and solution properties
Increase programming skills and familiarity with modern optimization packages, such as CVX/CVXPY, IPOPT, and more.
Interpret machine learning models as optimization problems

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. The course prerequisites are: - Calculus (MATH 51 and MATH 52 or the equivalent); - Multivariable calculus (MATH 53 or the equivalent); - Linear Algebra (MATH 54 or the equivalent); - Introduction to Programming, Computer or Data Science (ENGIN 7 or COMPSCI 61A or DATA C8 or the equivalent)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Moura

ENGIN 238E Robust Optimization and Applications 1 Unit

Terms offered: Prior to 2007

Robust optimization is concerned with decision-making under uncertainty, where the emphasis
is on guaranteeing a maximal level of performance despite unknown-but-bounded uncertainty.
This course covers the essentials of robust optimization and applications to various areas of
engineering and machine learning.

Objectives & Outcomes

Course Objectives: Students will learn the basic techniques and be exposed to various ways one can model uncertainty so that the robust optimization problem is easily solvable.The course aims to equip students to use optimization for real-world problems in a way that is resilient and reliable despite uncertainty.

Rules & Requirements

Prerequisites: Undergrad. degree STEM field, w/strong linear algebra background. Expected proficiency: Basic linear algebra concepts: vector norms, scalar products & hyperplanes. Useful but not required: symmetric matrices and their eigenvalues, PCA and SVD. Limited exposure
to basic concepts in optimization: optimiz. models, optimal value, constraints, feasible & optimal set. Moderate level/higher computing programming language: Python and/or Matlab EECS 127: Optimiz. Model1 recommended prior to class

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Ghaoui

ENGIN 241A Design and Analysis of Modern Structural Materials 1 1 Unit

Terms offered: Summer 2025

This course takes the students from atomic arrangements, to crystal structure, grain structure, texture, defects in materials, and #nally to thermodynamic assessment of materials microstructure. The main focus is on metallic materials with steel metallurgy and steel classi#cation being commonly used to demonstrate course content, while an introduction to ceramics are provided. Basic introduction in materials characterization is provided to give the students the background necessary to distinguish di#erent materials in use.

Objectives & Outcomes

Course Objectives: The main goal of the course is to provide an introduction from atomic arrangements, thermodynamic assessment of materials to microstructure, as well as to give the students the background necessary to distinguish di#erent materials in use.

Student Learning Outcomes: The students will learn crystal structure, grain structure, texture, defects, and a basic introduction in materials characterization is provided to give the students the background necessary to distinguish di#erent materials in use.

Rules & Requirements

Prerequisites: Undergraduate degree in STEM #eld. This course will build upon the principles learned in an introductory chemistry course, such as Chem 1A, and thus Chem 1A or its equivalent is recommended as a prerequisite. Also, the exploration of materials properties necessitates the reading interpretation of #gures and graphs understanding of slopes and related features, therefore a basic course in calculus such as Math 53 or its equivalent is recommended

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Hosemann, Sherburne

ENGIN 241B Introduction to Structural Materials II 1 Unit

Terms offered: Prior to 2007

This class builds upon the 241A “Introduction to Structural Materials 1” class and expands towards di#usion, phase diagrams, phase transformation, solidi#cation, and alloy systems. Examples include steels, aluminum and titanium alloys. Furthermore, composite materials and ceramics are featured for high performance applications.

Objectives & Outcomes

Course Objectives: The main goal of this course is to build upon the 241A “Introduction to Structural Materials I” class and expand towards di#usion, phase diagrams, phase transformation, solidi#cation, and alloy systems.

Student Learning Outcomes: The main goal of the course is to build upon 241A “Introduction to Structural Materials I” toward an understanding of how processing leads to structure and how to characterize the microstructures. Students will understand how defects a#ect properties. Also, students will gain an understanding of the criteria by which a working professional would select materials for speci#c applications.

Rules & Requirements

Prerequisites: 1.This course will build upon principles learned in an introductory chemistry course (ie Chem 1A or equivalent). 2. Exploration of materials properties necessitates the exploration of #gures, and interpretation of the #gures requires understanding of slope, therefore a basic course in calculus (ie Math 53 or equivalent recommended). 3. Students expected to have solid foundation in thermodynamics (ie Engin 40 or equiv.) 4. 241A “Introduction to Structural Materials I"

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Hosemann, Sherburne

ENGIN 245A Resilient Structural Systems to Natural Hazard 1 Unit

Terms offered: Prior to 2007

This course emphasizes background, theory, analysis, assessment, design frameworks & engineering tools to achieve resiliency of smart structural systems. We focus on use of sensors, structural analyses, experimental methods, & probabilistic modeling & structural health monitoring using artificial intelligence tools. Concepts are holistically integrated towards a paradigm of resilient design engineering of sustainable critical infrastructure systems
subjected to extreme and service conditions.
Course topics cover a variety of numerical methods, experimental methods, combination of numerical and experimental methods (hybrid simulation), structural health monitoring, structural reliability, decision making under uncertainty and deep learning.

Objectives & Outcomes

Course Objectives: The main goal of this course is to emphasize the background, theory, analysis, assessment, and
design frameworks and engineering tools to achieve resiliency of smart structural systems.

Student Learning Outcomes: The course will empower the participants with the general multipurpose trans-disciplinary knowledge, background and tools needed for successful assessment and design of resilient structural and infrastructural systems in the face of natural hazards and extreme events.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field (1) Skills-based requirements are: basic knowledge of mathematics, physics and basic programming. (2) Although not necessary, the following UG courses at UCB are suggested as prerequisites: CIV ENG 120 or equivalent, and CS C8 or equivalent

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Mosalam

ENGIN 245C Structural Fire Engineering 1 Unit

Terms offered: Prior to 2007

This course is focused on the design and assessment of structures subjected to #re. The course material emphasizes a 3-phase approach to structural-#re engineering: (1) #re modeling, (2) heat transfer modeling, and (3) structural modeling. Students will become familiar with both current prescriptive approaches to structural-#re engineering and emerging performance-based design approaches. Students will be able to appreciate several important topics related to performance of structures under the e#ect of #res.

Objectives & Outcomes

Course Objectives: The main goal of this course is to provide a background on the design and assessment of structures subjected to #re. The course material emphasizes a 3-phase approach to structural-#re engineering: (1) #re modeling, (2) heat transfer modeling, and (3) structural modeling.

Student Learning Outcomes: Students will become familiar with both current prescriptive approaches to structural-#re engineering and emerging performance-based design approaches. Students will be able to appreciate several important topics related to performance of structures under the e#ect of #res.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld (1) Skills-based requirements are: basic knowledge of mathematics (i.e. Math 53 and Math 54 or equivalent), physics (i.e. Physics 7A and Physics 7B or equivalent) and basic programming (COMPSCI C8 or equivalent). (2) Although not necessary, the following undergraduate course at UC Berkeley is suggested as a prerequisite: CIV ENG 120 or equivalent

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Mosalam, Eslami

ENGIN 247 Fundamentals of Modern Aerodynamic Design and Analysis 1 Unit

Terms offered: Summer 2025

This course aims at providing the basics of Aerodynamics for students and professionals who are considering the Aerospace industry as an academic focus area, a job target, or for those who are aircraft enthusiasts. A basic knowledge of mathematics (undergraduate level) is recommended for students to follow everything discussed in the course, but even without that the audience should be able to follow most of the course. Several experiments will be shown, and concepts are discussed with the help of videos of real-life scenarios, incidents and controlled-experiments.

Objectives & Outcomes

Course Objectives: To develop a fundamental understanding of #uid #ow with a focus on how air behaves near moving objects. Speci#cally, the objective is to learn about how lift is generated by airfoils, form and skin friction drags, separation, turbulence, wing boundary layer, and di#erent approximate theories to analyze #ight.

Student Learning Outcomes: By the end of this course, students should have an in-depth understanding of how aerial vehicles work, and be able to estimate di#erent characteristics of moving objects in air.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Speci#cally required courses (or their equivalent) follow below: - Math 53 (Multivariable Calculus) or equivalent - Math 54 (Linear Algebra & Di#erential Equations) or equivalent - Physics 7A and Physics 7B (Physics for Scientists and Engineers) or equivalent - ENGIN 7 (Introduction to Programming for Scientists and Engineers) or equivalent

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Alam

ENGIN 250 Feedback control for linear systems 1 Unit

Terms offered: Prior to 2007

This course provides an overview of the basic concepts in linear systems and feedback control. The first module of the course begins with an exploration of the feedback control problem and its applications in various #elds: robotics, manufacturing, tra#c, etc. We will present the unifying mathematical formulation of the problem, as well as its fundamental concepts: equilibrium and stability. In the second module we explore output feedback techniques. In the third module we describe the pole placement approach to state feedback, and couple it with the analogous state estimator. We conclude the course by solving the example of the previous module with state feedback techniques, and motivating other advanced topics in control theory.

Objectives & Outcomes

Course Objectives: The main goal of the course is to provide an overview of the basic concepts in linear systems and feedback control.

Student Learning Outcomes: An appreciation for the tradeo#s involved in control systems design.
An understanding of the behavior of linear systems and how they can be in#uenced with feedback control.
An understanding of the power and limitations of output feedback control with PID, and the versatility of pole placement coupled with state estimation.

Rules & Requirements

Prerequisites: Students who take this course should have a basic understanding of linear algebra, physics, and ordinary di#erential equations (e.g. Math 53, Math 54, Physics 7A, and Physics 7B or the equivalent). Students should also have programming skills (e.g. ENGIN 7 and ENGIN 177 or the equivalent)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Gomes

ENGIN 250A Analysis and Control of Nonlinear Systems 1 Unit

Terms offered: Fall 2025, Fall 2024
This course provides a basic introduction to nonlinear dynamical systems and their control. The #rst module begins with an overview of nonlinear system models,and types of behaviors that can only arise in nonlinear systems. The second module introduces Lyapunov stability theory and Lyapunov functions. The third module focuses on feedback control design for nonlinear systems, starting with back stepping as an example of Lyapunov-based feedback design to stabilize an operating point. The fourth module introduces feedback linearization for stabilization, then proceeds to sliding mode control for stabilization in the presence of model uncertainty. The course will illustrate all concepts with physically-motivated examples.

Objectives & Outcomes

Course Objectives: To provide an introduction to nonlinear systems and control.

Student Learning Outcomes: Ability to self-study further results in nonlinear control.
Familiarity with nonlinear control techniques, such as backstepping, feedback linearization, and sliding mode control.
Understanding of nonlinear systems and how their behavior can be regulated by feedback control.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. The following prerequisite courses or their equivalent are recommended: MATH 53; plus MATH 54 or EECS 16B. Note: the course 250 “Feedback Control for Linear Systems” is better taken before 250A, but 250 is not a prerequisite for 250A

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Arcak

ENGIN 251 Model Predictive Control for Autonomous Systems Introduction 1 Unit

Terms offered: Not yet offered
Forecasts are fundamental in new generation of autonomous & semi-autonomous systems. Predictions of systems dynamics, human behavior and environment conditions can improve safety & performance of resulting system. Predictive control is the discipline of feedback control where forecasts are used to change in real time behavior of a dynamical system. Optimization-based control design is a highly requested skill from many industries, including energy automotive, aerospace, process control & manufacturing. This course covers basic design of SISO & MIMO and predictive feedback controllers for linear & nonlinear systems. The student will be exposed to applying predictive control design & analysis tools to classical & modern control problems.

Objectives & Outcomes

Course Objectives: To enable students to understand the basic design predictive feedback controllers for autonomous systems. The student will understand when and how to apply predictive control design to autonomous systems including self-driving cars and robotic manipulators.

Student Learning Outcomes: The student will master the basic skills needed to apply predictive control design to modern control problems.
In particular, the participant will be exposed to and develop expertise in MPC control design, the tradeo# between linear and nonlinear modeling, pre-computation versus online optimization.

Rules & Requirements

Prerequisites: The recommended course prerequisites are ordinary di#erential equations (MATH 52, MATH 53, and MATH 54), PHYSICS 7A and PHYSICS 7B, and Programming (ENGIN 7 or DATA C100)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Borrelli

ENGIN 252 Legged Robots: How to Make Robots Walk and Run 1 Unit

Terms offered: Summer 2025
Bipedal robot locomotion is a challenging problem. This course will introduce students to the math behind bipedal legged robots. We will cover modeling and dynamics of legged robots, trajectory planning for designing walking and running gaits, and common control strategies to achieve the planned motions. The course also includes applied techniques of programming up a simulator with a dynamical model of a bipedal robot as well as a controller that stabilizes a walking gait. This course will take students through every step of the process, including:
Mathematical modeling of walking gaits in planar robots.
Analysis of periodic orbits representing walking gaits.
Algorithms for synthesizing feedback controllers for walking.
Algorithms for op
Objectives & Outcomes

Course Objectives: The goal of this course is to introduce students to the math behind bipedal legged robots. We will cover modeling and dynamics of legged robots, trajectory planning for designing walking and running gaits, and common control strategies to achieve the planned motions.

Student Learning Outcomes: Students in this course will learn applied techniques of programming up a simulator with a dynamical model of a bipedal robot as well as a controller that stabilizes a walking gait.

Rules & Requirements

Prerequisites: Undergraduate degree in STEM field. Background in dynamics (ME 104 or equivalent), background in linear differential equations and feedback control (ME 132 or equivalent) will be required. Additionally, some knowledge of state-space models and linear algebra will also be helpful

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Sreenath

ENGIN 253 Flying Robots: From Small Drones to Aerial Taxis 1 Unit

Terms offered: Fall 2025, Fall 2024
Aerial robots are increasingly becoming part of our daily lives. This course is aimed at a broad audience, and intends to give an introduction to the main considerations made when designing aerial robots. We will consider sizes ranging from less than 1 kilogram to vehicles that can carry multiple passengers. Using simple physics, we will derive some fundamental constraints and trade-offs. We will also discuss autonomy of such systems, and specifically different components used in the sense-decide-act feedback control loop.
Objectives & Outcomes

Course Objectives: This course intends to give an introduction to the main considerations made when designing aerial robots.

Student Learning Outcomes: At the end of the course the student will have an understanding of the physics governing aerial robotics; the most important forms of actuation and sensing; and a high-level understanding of how autonomous flight is achieved through feedback.

Rules & Requirements

Prerequisites: Multivariable calculus, Linear algebra, Di#erential equations (e.g. Math 53 & 54). Engineering physics (e.g. Physics 7A and Physics 7B)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Mueller

ENGIN 254 Model Predictive Control for Energy Systems - Introduction 1 Unit

Terms offered: Not yet offered
Predictive control is the discipline of feedback control where forecasts are used to change in real time the behavior of a dynamical system. Optimization-based control design is a highly requested skill from a number of industries, including energy, automotive, aerospace, process control and manufacturing. Forecasts are fundamental in the new generation of autonomous and semi-autonomous energy systems. This course covers the basic design of applied predictive control. The student will be exposed to how to apply predictive control design and analysis tools to classical and modern control problems with application to renewable energy systems including solar power plants, energy storage systems and Heating, Ventilation and Air Conditioning (HV

Objectives & Outcomes

Course Objectives: To enable students to understand the basic design predictive feedback controllers for energy systems. The student will understand when and how to apply predictive control design to autonomous systems including solar power plants and HVAC.

Student Learning Outcomes: The student will master the basic skills needed to apply predictive control design to modern energy systems. In particular, the participant will be exposed to and develop expertise in MPC control design for energy storage, solar power plants and HVAC systems.

Rules & Requirements

Prerequisites: The recommended course prerequisites are: Ordinary differential equations (e.g. MATH 52, MATH 53, and MATH 54 or the equivalent), Physics (PHYSICS 7A and PHYSICS 7B or the equivalent), and Programming (ENGIN 7 or DATA C100 or the equivalent)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Borrelli

ENGIN 260A Models in Engineering 1 Unit

Terms offered: Prior to 2007
The #rst module begins with foundational concepts and an overview of the use of models in engineering. What is a model? What is the role of data and measurements? The second module will be devoted to mechanistic models: those that are built on prior physical principles. We will classify these into static and dynamical models. The third module will focus on data-based models, culminating with the modern techniques of deep learning. In the process we will learn the basic techniques of linear regression and logistic regression, as well as practical considerations such as training versus testing data sets and over-#tting.

Objectives & Outcomes

Course Objectives: The main goal of the course is to provide foundational concepts and an overview of the use of models in engineering to answer questions such as: What is a model? What is the role of data and measurements? What are mechanistic, data-based, and mixed models? What are static and dynamical models? Where do optimization theory and control theory #t in?

Student Learning Outcomes: 1.
A uni#ed understanding of a number of modeling techniques, including regression, classi#cation (deep neural networks), di#erential equations, and #nite elements.
2.
A grasp of the role of control theory and optimization in solving engineering problems.
3.
A broad view of the available techniques, which will allow them to make better engineering decisions in their academic and professional careers.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM #eld. Students who take this course should have a basic understanding of linear algebra and ordinary di#erential equations (e.g. Math 54 or the equivalent). They should also be familiar with the basic concepts of probability and statistics: random variables, Gaussian distribution. We will implement many of the concepts in Matlab and/or Python, so some knowledge of one of these languages is needed ENGIN 7, COMPSCI C8, COMPSCI 10, or the equivalent)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Gomes

ENGIN 264 Applied Continuum Mechanics 1 Unit

Terms offered: Not yet offered
Continuum mechanics is a powerful method of modeling various physical systems. In this course, we explore the essential elements for describing system states and formulate balance laws to ensure correct system response, aligning with the goal of describing the basic elements of various continuum models. We apply the developed methodology to basic elasticity problems and then to poroelastic systems, batteries, and piezoelectric material systems, enabling students to formulate continuum descriptions for elastic, poroelastic, chemoelastic, and piezoelectric systems.

Objectives & Outcomes

Course Objectives: Students will also learn to develop continuum mechanical problems and derive numerical solutions using modern computational methods, such as the finite element method.
The course provides a solid foundation for understanding how continua, both simple and complex, are modeled.
This course equips students with a sophisticated perspective on modeling questions that arise in various engineering problem classes.

Student Learning Outcomes: Describe the basic elements of a variety of continuum models of engineering systems.
Develop continuum mechanical problems and set up numerical approximations using contemporary computational techniques.
Explain how continua, both simple and complex, are modeled.
Formulate continuum descriptions for elastic, poroelastic, chemoelastic, and piezoelectric material systems.

Hours & Format

Fall and/or spring: 7 weeks - 1 hour of lecture per week

Summer: 7 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Govindjee

ENGIN 264A Modeling and Analyzing the Dynamics of Location and Gripping Soft Robots 1 Unit

Terms offered: Prior to 2007
Motivated by applications to health care, the field of soft robotics has witnessed explosive
growth in the past decade. Most research has focused on prototype design and development
while engineering analyses and material science research have slowly lagged. This course has
been constructed to introduce nonlinear models and analyses of soft robotic devices whose
primary purpose is either to locomote or grip. During the course, students will be exposed to the rapidly developing field of soft robotics and learn some of the technical challenges in this field. Students will learn about the wide range of nonlinear modeling strategies that can be used to develop mathematical models for the dynamics of a soft robot.

Objectives & Outcomes

Course Objectives: The course objectives include surveying the rapidly developing field of soft robotics. Through case studies and a capstone project, students will develop skills in and an appreciation for the wide range of possible modeling techniques and analyses available with which to explore the dynamics of soft robotic devices.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Summer: 5 weeks - 1 hour of web-based discussion and 2.6 hours of web-based lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: O'Reilly

ENGIN 266A Finite Difference Methods for Fluid Dynamics 4 Units

Terms offered: Fall 2012, Fall 2010, Spring 2007
Application of finite difference methods to current problems of fluid dynamics, including compressible and incompressible flow. Sponsoring department: Mechanical Engineering.
Rules & Requirements

Prerequisites: A graduate-level course in fluid dynamics or numerical methods for differential equations, or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Marcus

Formerly known as: 266

ENGIN 266B Spectral Methods for Fluid Dynamics 4 Units

Terms offered: Fall 2023, Spring 2020, Spring 2018
Application of spectral methods to current problems of fluid dynamics, including compressible and incompressible flow. Sponsoring department: Mechanical Engineering.
Rules & Requirements

Prerequisites: A graduate-level course in fluid dynamics or numerical methods for differential equations, or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Marcus

Formerly known as: 266

ENGIN 270A Organizational Behavior for Engineers 1 Unit

Terms offered: Fall 2021, Fall 2020, Fall 2019
Designed for professionally-oriented engineering graduate students, this course explores key topics in organizational behavior, including negotiations, power and conflict.
Rules & Requirements

Prerequisites: Admission to MEng or MTM program

Hours & Format

Fall and/or spring:
2 weeks - 6-8 hours of lecture per week
8 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270B R&D Technology Management & Ethics 1 Unit

Terms offered: Fall 2022, Fall 2021, Fall 2020
Designed for professionally-oriented engineering graduate students, this course explores key topics in R&D technology management and ethics through faculty-led case analysis and discussion.
Rules & Requirements

Prerequisites: Admission to MEng or MTM program

Hours & Format

Fall and/or spring:
2 weeks - 6-8 hours of lecture per week
8 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270C Teaming & Project Management 1 Unit

Terms offered: Spring 2025, Spring 2023, Fall 2022
Designed for professionally-oriented engineering graduate students, this course applies key topics in project management and team dynamics to students concurrent capstone projects.
Rules & Requirements

Prerequisites: Admission to MEng or MTM program

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

Hours & Format

Fall and/or spring:
8 weeks - 1.5 hours of lecture per week
12 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Himelstein

ENGIN 270D Entrepreneurship for Engineers 1 Unit

Terms offered: Spring 2022, Spring 2021, Spring 2020
Designed for professionally-oriented engineering graduate students, this course explores key topics in entrepreneurship and entrepreneurial finance.
Rules & Requirements

Prerequisites: Admission to MEng or MTM program

Hours & Format

Fall and/or spring:
2 weeks - 6-8 hours of lecture per week
10 weeks - 1.5-1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Mason

ENGIN 270E Technology Strategy & Industry Analysis 1 Unit

Terms offered: Spring 2017
Designed for professionally-oriented engineering graduate students, this course explores key topics in technology strategy and industry analysis.
Rules & Requirements

Prerequisites: Admission to MEng or MTM program

Hours & Format

Fall and/or spring: 2 weeks - 6-8 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270F Data Analytics 1 Unit

Terms offered: Spring 2017
Designed for professionally-oriented engineering graduate students, this course explores key topics in data analytics.
Rules & Requirements

Prerequisites: Admission to MEng or MTM program

Hours & Format

Fall and/or spring: 2 weeks - 6-8 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270G Marketing & Product Management 1 Unit

Terms offered: Spring 2022, Spring 2021, Spring 2020
Designed for professionally-oriented engineering graduate students, this course explores key topics in marketing and product management.
Rules & Requirements

Prerequisites: Admission to MEng or MTM program

Hours & Format

Fall and/or spring:
2 weeks - 6-8 hours of lecture per week
7 weeks - 2-2 hours of lecture per week
10 weeks - 1.5-1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270H Accounting & Finance for Engineers 1 Unit

Terms offered: Spring 2022, Spring 2021, Spring 2020
Designed for professionally-oriented engineering graduate students, this course explores key topics in accounting and finance.

Rules & Requirements

Prerequisites: Enrollment in MEng or MTM programs

Hours & Format

Fall and/or spring:
2 weeks - 7.5 hours of lecture per week
7 weeks - 2 hours of lecture per week
10 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270I Technology Strategy for Engineering Leaders 1 Unit

Terms offered: Spring 2022, Spring 2021, Spring 2020
Designed for MEng and MTM students, this course explores key topics using the case discussion method. We will discuss technology strategy with the following meta themes; we will open with a case that applies traditional strategy analysis, contrast the traditional framework with new conceptions of platforms and competition. We'll come to understand traditional economies of scale and barriers to entry and contrast those with network dynamics, winner take all markets, and platform strategy. Finally, we will critique platform competition and debate how platforms and their competitive dynamics will change business and society.

Rules & Requirements

Prerequisites: Enrollment in the MEng or MTM programs

Hours & Format

Fall and/or spring:
2 weeks - 7 hours of lecture per week
7 weeks - 2-2 hours of lecture per week
10 weeks - 1.5-1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270J Industry Analysis for Engineering Leaders 1 Unit

Terms offered: Spring 2022, Spring 2021, Spring 2020
Designed for professionally-oriented engineering graduate students, this course explores key topics in industry analysis.

Rules & Requirements

Prerequisites: Enrollment in the MEng or MTM programs

Hours & Format

Fall and/or spring:
2 weeks - 7 hours of lecture per week
7 weeks - 2-2 hours of lecture per week
10 weeks - 1.5-1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270K Coaching for High Performance Teams 1 Unit

Terms offered: Prior to 2007
Designed for professionally-oriented engineering graduate students, this course applies key topics in project management and team dynamics to students concurrent capstone projects.

Rules & Requirements

Prerequisites: Open to MEng or MTM students only

Credit Restrictions: Students will receive no credit for ENGIN W270K after completing ENGIN 270K. A deficient grade in ENGIN W270K may be removed by taking ENGIN 270K.

Hours & Format

Fall and/or spring:
8 weeks - 0.25 hours of workshop and 0.25 hours of lecture per week
8 weeks - 0.25 hours of workshop and 0.25 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Beliaev

Formerly known as: Engineering W270K

ENGIN 270L Global Leadership Expertise 1 Unit

Terms offered: Spring 2022, Spring 2021, Spring 2020
The objective of this course is to provide Master of Engineering and Master of Translational Medicine students with insights into the type of leadership skills required to be a successful cross-cultural leader in today's increasingly complex global marketplace.
Objectives & Outcomes

Course Objectives: Over the course of this intensive boot camp, students will be required to employ technical abilities and multidisciplinary analysis while examining and engaging in case studies, simulations, and in-class exercises in order to achieve some key course goals:
• Develop a global mindset
• Become more interculturally competent
• Learn to lead people from different cultures
• Understand the implications of global leadership

Student Learning Outcomes: The goal is for each student to develop a personalized global leadership "toolkit" that they will be able utilize as their professional careers unfold. There will be a specific focus on how to deploy that “toolkit” to assist with business decision making in the fiduciary context.

Rules & Requirements

Prerequisites: Enrollment in the MEng or MTM programs

Hours & Format

Fall and/or spring:
2 weeks - 7.5 hours of lecture per week
7 weeks - 2-2 hours of lecture per week
10 weeks - 1.5-1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Himelstein

ENGIN 270M Professional Ethics in Technology, Law and Business 1 Unit

Terms offered: Spring 2022, Spring 2021, Spring 2020
Designed for MEng and MTM students. Over the course of the boot camp, students will gain proficiency in verbal leadership, through discussions of technology, legal and business case studies. Topics will include technology management, governance, privacy and disclosure, codes of conduct, whistleblowing, internal investigations, ethical and effective business practices in foreign countries, and ethical and effective leadership.
Objectives & Outcomes

Course Objectives: Students will be required to employ technical and qualitative analysis while digesting and dissecting case studies, in-class projects, and guest speaker presentations. Class discussions will focus on issues raised in case studies, including analysis, brainstorming, diagnosis, and recommendations.

Student Learning Outcomes: Students will gain exposure to a wide variety of leadership approaches, technologies, personalities, and business models.

Rules & Requirements

Prerequisites: Enrollment in the MEng or MTM programs

Hours & Format

Fall and/or spring:
2 weeks - 7.5 hours of lecture per week
7 weeks - 2-2 hours of lecture per week
10 weeks - 1.5-1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270N Innovation Management 1 Unit

Terms offered: Spring 2022
Designed for MEng and MTM students. This 1 unit elective provides an in-depth look at the discipline and function of innovation management. The class begins by answering the questions, “What is innovation, innovation management, and how does it differ from product management”. Modules then cover setting an innovation strategy, building support structures inside firms, managing innovation pipelines and processes, and creating a holistic innovation culture. Last, students will get an in-depth look at a “day in the life” of an innovation manager and finish with a class project.
Hours & Format

Fall and/or spring:
2 weeks - 6.75-7.5 hours of lecture per week
10 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270P Power and Persuasion for Engineering Leadership 1 Unit

Terms offered: Spring 2022
This course is designed to provide Masters of Engineering and Masters of Translational Medicine students the opportunity to develop their skills and confidence in power and influence dynamics. It can help change how you see the world and move through it. Future leaders in technology and scientific fields will learn to avoid over-reliance on rational persuasion and apply power dynamics skillfully.
Hours & Format

Fall and/or spring:
2 weeks - 6.75-7.5 hours of lecture per week
10 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 270Q The Power of Diversity and Inclusion for Engineering Leaders 1 Unit

Terms offered: Prior to 2007
Engineering efforts in a globalized, multicultural world require a variety of techniques to effectively lead diverse teams. This course examines Diversity, Equity, and Inclusion (DEI) goals, best practices, and strategies of today's inclusive leaders. Through professional interactions, examination of current research, and understanding the competitive advantage of DEI initiatives, students will be prepared to successfully lead in diverse engineering environments.
Hours & Format

Fall and/or spring:
2 weeks - 6.75-7.5 hours of lecture per week
8 weeks - 1.5 hours of lecture per week
10 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Yang

ENGIN 270R Product Management for Engineering Leaders 1 Unit

Terms offered: Prior to 2007
An understanding of the role of Product Manager, and the core skills and frameworks that are the basis of good product practices are important for anyone who wants to build
great products that address customer needs and drive true business value. In this highly interactive course, you'll learn about the product development lifecycle & what makes a good product manager. You'll also dig into tactics and core product skills such as building hypothesis & impactful problem statements, conducting effective user interviews, financial modeling/business case development, building a roadmap & backlog, slicing scope for iterative development, prioritization, storytelling, and user journey mapping using real world examples & hands on practice.
Hours & Format

Fall and/or spring:
2 weeks - 6-7.5 hours of lecture per week
8 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Wellborn

ENGIN 270S Agile Product Development for Engineering Leaders 2 Units

Terms offered: Prior to 2007
This course gives 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) at the Finals. Student teams design a product that will solve real problems and start implementing series of 3 prototypes culminating with a working product MVP. Students will be introduced to professional product development processes & approaches through series of lectures, case study analysis, simulations and exercises and apply these techniques to their development approach.
Rules & Requirements

Prerequisites: Enrollment in the MEng or MTM degree programs

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Erbilgin

ENGIN 273 Deep Tech Commercialization Strategies 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
This course explores deep technology commercialization at the interface of business, technology, and intellectual property. Students will work in interdisciplinary teams on real-world, deep tech commercialization projects from leading research institutions and startups. Using the concepts taught in the course, student-led teams will conduct technology and patent analyses, explore the competitive technology landscape, and uncover market entry opportunities to assess the commercial potential of the technology. This is an incredible opportunity to gain real-world experience while learning the fundamentals of deep tech commercialization.

Objectives & Outcomes

Course Objectives: Apply an interdisciplinary toolset to support the process of technology capture, positioning, and commercialization by mapping and analyzing competitive technology positions, market positions, and IP-based control positions.
Evaluate and prioritize commercial opportunities by identifying potential customer value propositions, business models, and revenues.
Expose students to the strategic intersection of technology, business, and intellectual property (IP) that is inherent to commercializing deep tech innovations.
Hone communication and leadership skills through customer discovery, presenting to peers and industry professionals, and providing recommendations (both positive and negative) to project team leaders throughout the course.
Learn frameworks to identify and analyze the key technology and IP assets that make up the foundational building blocks of a deep tech innovation.

Student Learning Outcomes: Students will learn real-world strategies to analyze deep technology innovations from the perspective of technology, IP, and commercialization. Students will learn how to professionally interact with a variety of people from potential customers to tech transfer officers, and leading researchers. They will have gained practical experience applying a unique interdisciplinary toolset to assess the potential to commercialize deep tech innovations.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 274 Deep Tech Innovation & Entrepreneurship 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course explores the challenges of deep technology innovation and entrepreneurship at the interface of business, technology, and intellectual property. Students will work in interdisciplinary teams with real-world, deep tech ventures that have recently been launched from leading research universities, labs, and startups. The early-stage venture focus of this course gives students the opportunity to work closely with a founder team to solve the challenges of market entry, scaling-up, building strategic partnerships, overcoming regulatory hurdles, and gaining access to financing in the face of global competition. Gain real-world experience while learning the fundamentals of deep tech innovation and entrepreneurship.

Objectives & Outcomes

Course Objectives: Evaluate and develop market entry and business model scenarios.
Expose students to the strategic intersection of technology, business, and intellectual property (IP) that is inherent to deep tech ventures and entrepreneurship.
Hone communication and leadership skills through customer discovery, presenting to peers and industry professionals, and providing recommendations (both positive and negative) to venture founders throughout the course.
Learn how startups search and apply new information to pivot to alternative commercial opportunities.
Learn to adapt leading-edge theoretical models for practical use in a complex commercial environment.

Student Learning Outcomes: Students will develop practical skills critical for success in the deep tech space, focusing on areas such as venture/startup formation, business model development, technology marketing strategies, value chain mapping, competitive landscape analysis, and methods for value creation and capture. They will have gained practical experience applying a unique interdisciplinary toolset to develop an early-stage deep tech venture.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 280A Electronic Properties of Materials 1 Unit

Terms offered: Fall 2025, Fall 2024
Introduction to the physical principles underlying the electronic properties of solids from macroscopic to nano dimensions. General solid state physics will be taught in the context of technological applications, including the structure of solids, behavior of electrons and atomic vibration in periodic lattice, and interaction of light with solids. Emphasis will be on semiconductors and the materials physics of electronic and optoelectronic devices.
Objectives & Outcomes

Course Objectives:
Students will gain a fundamental understanding of the following topics: i) electrical conduction
(transport) in solids based on quantum mechanics and modern band theory, ii) lattice vibration
and thermal conduction (transport) in solids, iii) major properties of bulk and nanostructured
semiconductors, iv) effects of dopant impurities and defects in semiconductors, and v) the
principles of light-solid interactions.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Wu

ENGIN 280E Photovoltaic Materials 1 Unit

Terms offered: Prior to 2007
This course focuses on the fundamentals of photovoltaic energy conversion with respect to the physical principles of operation and design of e#cient semiconductor solar cell devices. This course aims to equip students with the concepts and analytical skills necessary to assess the utility and viability of various modern photovoltaic technologies in the context of a growing global renewable energy market.
Objectives & Outcomes

Course Objectives: The main goal of this course is to provide an overview of the fundamentals of photovoltaic energy conversion with respect to the physical principles of operation and design of e#cient semiconductor solar cell devices.

Student Learning Outcomes: Students will learn the concepts and analytical skills necessary to assess the utility and viability of various modern photovoltaic technologies in the context of a growing global renewable energy market.

Rules & Requirements

Prerequisites: Students should have a background in chemistry, physics, and mathematics, including what is covered in UC Berkeley’s Chem 1A, Physics 7A, Physics 7B, Physics 7C, and Math 53 or their equivalents

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Balushi, Sherburne

ENGIN 281 Development of Modern Materials for the Microelectronics Industry 1 Unit

Terms offered: Prior to 2007

This course covers the materials science and processing of thin #lm coatings that incorporates fundamental knowledge of materials transport, accumulation, defects and epitaxy. Through this course, an understanding of the fundamental physical and chemical processes which are involved in crystal growth and thin #lm fabrication will be gained. Important synthesis and processing techniques used for the fabrication of electronic and photonic devices will be discussed. Finally, this course will provide an understanding of how material characteristics are in#uenced by processing and deposition conditions. This course is designed to directly address current challenges and future needs of the semiconductor and coating industries.

Objectives & Outcomes

Course Objectives: The main goal of this course is to provide an overview of the materials science and processing of thin #lm coatings that incorporates fundamental knowledge of materials transport, accumulation, defects and epitaxy. This course is designed to directly address current challenges and future needs of the semiconductor and coating industries.

Student Learning Outcomes: Through this course students will gain an understanding of the fundamental physical and chemical processes which are involved in crystal growth and thin #lm fabrication.

Rules & Requirements

Prerequisites: Undergraduate degree in engineering, physics or chemistry. Physics 7A & 7B or equivalent recommended

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Balushi, Sherburne

ENGIN 281A Quantum Physics for Semiconductor Engineers 1 Unit

Terms offered: Spring 2025

This is an introduction to non-relativistic quantum physics. General quantum mechanics will be taught in the context of technological relevance, including the brief history and introduction to quantum mechanics, the Schrodinger equation and its solution in one and three dimensions, the formalism of quantum mechanics, and the perturbation theory. Connections to basic atomic, laser and materials physics will be highlighted.

The course will prepare students with the basics of quantum physics for entering the emerging field of quantum computation, quantum communications and other quantum information science and technologies.

Objectives & Outcomes

Course Objectives: Course objectives are to equip students with a fundamental understanding of the following topics: i) basic concepts of quantum physics, ii) Schrodinger equation solutions to simple quantum systems, iii) notations and language of quantum mechanics, and iv) perturbation theory and quantum transitions.

Student Learning Outcomes: Students will be able to establish and solve Schrodinger equation in simple quantum systems in one dimension and higher dimensions.

Students will be able to use perturbation theory to describe quantum effects such as optical quantum transitions.

Students will be familiar with basic concepts of quantum physics, such as wavefunctions, eigen-states and eigen energies.

Students will understand the notations and language of quantum mechanics, including operators, the Dirac brackets and the Hilbert space.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field; knowing basic, college-level physics (Physics 7A & 7B) and mathematics (Math 53 & 54)

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Junqiao Wu

ENGIN 282 Techniques for Electronic Devices Fabrication 1 Unit

Terms offered: Fall 2025, Fall 2024
This course is designed to give an introduction, and overview of, the techniques used in fabrication of electronic devices. Topics such as materials deposition, patterning, laboratory safety and best practices will be covered. The students will learn basic processes used in the fabrication of silicon-based devices and novel semiconducting materials. After covering the fundamental processes and technologies needed to form an electronic device, the fabrication flow of NMOS devices will be studied in detail.

Objectives & Outcomes

Course Objectives: The objective of this course is to provide the student with a fundamental understanding of the basic techniques used for deposition, patterning and integration of electronic materials for the purpose of forming a functional electronic device. By the end of the course, students will be able to design a device and propose a fabrication and process flow.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field. Skills needed are basic physics and math skills. Recommended prerequisite courses from Berkeley: EE16A,B or Math 53 and Physics 7B

Hours & Format

Fall and/or spring: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 5 weeks - 2.6 hours of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Arias

ENGIN C282 Charged Particle Sources and Beam Technology 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2020, Fall 2015, Fall 2013, Fall 2011
Topics in this course will include the latest technology of various types of ion and electron sources, extraction and formation of charge particle beams, computer simulation of beam propagation, diagnostics of ion sources and beams, and the applications of beams in fusion, synchrotron light source, neutron generation, microelectronics, lithography, and medical therapy. This is a general accelerator technology and engineering course that will be of interest to graduate students in physics, electrical engineering, and nuclear engineering.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Leung, Steier

Also listed as: NUC ENG C282

ENGIN 283 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. Students may enroll in multiple sections of this course within the same semester.

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/Graduate

Grading: Letter grade.

ENGIN 283A 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/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Formerly known as: Industrial Engin and Oper Research 295

ENGIN 286 Fundamentals of Photovoltaic Devices 1 Unit

Terms offered: Not yet offered
This course offers an in-depth exploration of the fundamentals of photovoltaic devices, covering topics such as charge generation, recombination in semiconducting materials, drift and diffusion currents, and p-n junctions. The course is designed for engineering graduate students and working professionals in the electronic/energy industry who seek to update their knowledge and skills. Emphasis will be given to different solar cell technologies, including monocrystalline, thin film, and third-generation solar cells, with a focus on their design, analysis, and application.

Objectives & Outcomes

Student Learning Outcomes: Analyze the fundamental principles of solar energy harvesting, evaluate modern applications and primary photovoltaic markets, and apply this knowledge to design effective solar cell systems for the solar industry or related fields.
Comprehend basic semiconductor physics relevant to photovoltaics, including charge generation, recombination, drift, and diffusion.
Design and optimize manufacturing processes for various photovoltaic technologies.
Determine current-voltage characteristics and extract efficiency of photovoltaic cells.
Evaluate the manufacturing costs and performance metrics of different photovoltaic systems.
Identify key requirements for solar cell systems across different market segments.

Hours & Format

Fall and/or spring: 7 weeks - 1 hour of lecture per week

Summer: 7 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Arias

ENGIN 290 Special Topics in Management of Technology 2 or 3 Units

Terms offered: Spring 2012, Fall 2011, Spring 2011
Specific topics, hours and units of credit will vary from section to section, year to year. Courses are related classes in the Management of Technology certificate program.

Rules & Requirements

Prerequisites: Graduate standing

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

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 290A Introduction to Management of Technology 3 Units

Terms offered: Spring 2012, Spring 2011, Spring 2010

This course is designed to give students a broad overview of the main topics encompassed by management of technology. It includes the full chain of innovative activities beginning with research and development and extending through production and marketing. Why do many existing firms fail to incorporate new technology in a timely manner? At each stage of innovation, we examine key factors determining successful management of technology. What constitutes a successful technology strategy? The integrating course focus will be on the emergence of the knowledge economy and technology as a key knowledge asset and will involve both general readings and cases. The course also introduces students to Haas and COE faculty working in the relevant areas.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Proctor

ENGIN 290B Biotechnology: Industry Perspectives and Business Development 2 Units

Terms offered: Fall 2011, Fall 2010, Fall 2009

This course is designed to examine the strategic issues that confront the management of the development stage biotech company, i.e., after its start-up via an initial capital infusion, but before it might be deemed successful (e.g., by virtue of a product launch), or otherwise has achieved "first-tier" status. Thus, the intention is to study the biotech organization during the process of it growth and maturation from an early stage existence through "adolescence" into an "adult" company. The focus of the class will be on business development, i.e., the deal making that must occur to accomplish the corporate objectives of bringing in new technologies and getting the initial products to market. We will explore the critical deal issues from both the perspective of the development stage company and the viewpoint of the larger, more mature biotech or big pharma company with which it seeks to partner.

Rules & Requirements

Credit Restrictions: Students will receive no credit for 290E after taking Master of Business Administration 290B or Evening Weekend Master of Business Administration 290B.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Hoover, Sanders

ENGIN 290E Marketing Emerging Technologies 3 Units

Terms offered: Fall 2011, Fall 2010

The primary goal of this course is to develop in the student the marketing skills needed to compete aggressively as an entrepreneur in technology fields. Upon completion of the course, the student should have developed the following skills: the ability to assess and predict customer needs in markets that may not yet exist; the ability to create and execute marketing plans that necessarily integrate sophisticated technological development with rapidly evolving customer requirements; the ability to create and grow a focused marketing organization rapidly and efficiently; and the ability to create and use marketing communications to reach prospects, customers, OEMs, and sales channels efficiently and inexpensively.

Rules & Requirements

Credit Restrictions: Students will receive no credit for 290E after taking Master of Business Administration 290E.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Isaacs

ENGIN 290G International Trade and Competition in High Technology 3 Units

Terms offered: Prior to 2007

This course seeks to make sense of, inter alia, the decline and prospective recovery of U.S. high-technology industries, the evolution of innovation and technology strategies and policies in Western Europe and Asia, the historic and current roles of governments in shaping markets for high-technology goods, and the impact on business strategies of recent developments in early-stage capital markets. Our general approach views technological innovation and competition as dynamic processes that reflect previous choices made by firms and governments. Modern technologies develop in markets that are international scope, often imperfectly competitive, and subject to influence by a variety of economic and political stakeholders. We will use an eclectic mix of theoretical, historical, and practical perspectives throughout the course in examining these issues, although no special familarity with any of these is assumed. From time to time, we will be joined by venture capitalists, corporate executives, and technologists engaged in global high-technology markets for discussion of these issues.

Rules & Requirements

Credit Restrictions: Students will receive no credit for 290G after taking Master of Business Administration 290G.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Wu

ENGIN 290H Management of Technology - Doing Business in China 2 Units

Terms offered: Fall 2009

This course prepares students to found a startup business in China or to work with an MNC in China, develops their critical analysis and strategic decision tools and skills needed to compete in the world's most dynamic emerging market, and provides access and useful introductions/Guanxi to aid future business development in China.

Rules & Requirements

Credit Restrictions: Students will receive no credit for 290H after taking Master of Business Administration 290H.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Sanderson

ENGIN 290J Entrepreneurship in Biotechnology 2 Units

Terms offered: Spring 2012, Spring 2011, Spring 2010

This course will provide students an introduction to the complexities and unique problems of starting a life sciences company. It is designed for both entrepreneurs and students who may someday work in a biotechnology or medical device startup. Students will be exposed to the topics most critical for successfully founding, financing, and operating a life science company, and will be expected to perform many of the same tasks that founders would normally undertake. Discussions with life-science entrepreneurs, case studies of recent companies, and hands-on work developing entrepreneurial endeavors will all be utilized.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Lasky

ENGIN 290O Opportunity Recognition: Technology and Entrepreneurship in Silicon Valley 3 Units

Terms offered: Spring 2012, Fall 2011, Spring 2011

This course is intended to provide the core skills needed for the identification of opportunities that can lead to successful, entrepreneurial high technology ventures, regardless of the individual's "home" skill set, whether technical or managerial. We examine in depth the approaches most likely to succeed for entrepreneurial companies as a function of markets and technologies. Emphasis is placed on the special requirements for creating and executing strategy in a setting of rapid technological change and limited resources. This course is open to both MBA and Engineering students (who enroll through the College of Engineering), and is particularly suited for those who anticipate founding or operating technology companies.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 290P Project Management 2 Units

Terms offered: Spring 2012, Spring 2011, Spring 2010
This course will provide you with a comprehensive view of the elements of modern project management, guidelines for success, and related tools. In organizations today, successful operations keep the organization alive and successful projects move it towards strategic objectives. A project is a one-time or infrequently occurring operation with a unique goal, limited lifespan, and limited resources. The fundamental concepts come from the field of operations management, but projects present special types of operations because of their intended focus, limited lives, constraints, and uncertainties. In organizations today, projects are many, diverse, and frequently overlapping.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 290S Supply Chain Management 3 Units

Terms offered: Fall 2011, Fall 2010, Fall 2009
This course involves the flows of materials and information among all of the firms that contribute value to a product, from the source of raw materials to end customers. Elements of supply chain management have been studied and practiced for some time in marketing, logtistics, and operations management. We will attempt to integrate these different perspectives to develop a broad understanding of how to manage a supply change. This course will focus on effective supply chain strategies for companies that operate globally with emphasis on how to plan and integrate supply chain components into a coordinated system. You will be exposed to concepts and models important in supply chain planning with emphasis on key trade offs and phenomena. The course will introduce and utilize key tactics such as risk pooling and inventory placement, integrated planning and collaboration, and information sharing. Lectures, Internet simulations, computer exercises, and case discussions introduce various models and methods for supply chain analysis and optimization.

Rules & Requirements

Credit Restrictions: Students will receive no credit for 290S after taking Master of Business Administration 248A or Evening Weekend Master of Business Administration 248A.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Angelus

ENGIN 291A Introspective and Authentic Leadership 1 Unit

Terms offered: Not yet offered
This course provides the framework for personal leadership development through introspection and self-reflection. Topics include developing self-awareness; understanding our unique strengths; fostering authenticity and belonging; working in flow; managing time and life-balance; leading with purpose; navigating difficult conversations; inspiring teams and cultivating awareness. The class culminates with creation of a personal leadership development plan.

Objectives & Outcomes

Course Objectives: This course will help you develop the essential skills and mindset of a successful leader by engaging in key reflections and discussions, self-exploration exercises, and learning important strategies and approaches for authentic leadership. By the end of this course, you will have a deeper understanding of yourself as a leader and a clear vision of how to lead others with authenticity and compassion.

Student Learning Outcomes: Students will learn how to manage time effectively, communicate authentically, develop self-awareness, foster teamwork and collaboration, and reflect on their strengths. Students will (i) explore their leadership journey, (ii) discover their authentic leadership style, and (iii) develop a personal leadership plan.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field

Credit Restrictions: Students will receive no credit for ENGIN 291A after completing ENGIN 291A. A deficient grade in ENGIN 291A may be removed by taking ENGIN 291A.

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Lisa Pruitt

ENGIN 291B Positive Leadership for Engineers 1 Unit

Terms offered: Fall 1996
Positive leadership is the science and application of the leader's character strengths and subjective experiences to create a personal leadership style that supports employee engagement, productivity, innovation, organizational citizenship, and a culture of well-being. Many Silicon Valley companies already actively promote the creation of a culture of well-being. The course is divided into three sections, (I) gaining insight into one's individual psychological operating system, (II) positive psychology as a foundation for leadership development, and (III) positive leadership application strategies. The course will conclude with the development of a personal leadership plan.
Objectives & Outcomes

Course Objectives: (I)
gaining insight into one's individual psychological operating system,
(II) positive psychology as a foundation for leadership development (III) positive leadership application strategies.

Student Learning Outcomes: Develop a 5-year personal leadership plan that draws upon identified strengths and various theories to guide students toward becoming successful leaders.
Explore how empathy, gratitude, positive emotions, job crafting, meaning in work, forgiveness, and character strengths can be used to connect better to teammates, followers, and stakeholders.
Understand how the science and application of Positive Psychology and Positive Leadership Theory can help leaders motivate employees and create a culture of wellbeing.
•
Examine how our subjective experiences and crucibles shape how we engage, interact, and respond to others.

Rules & Requirements

Prerequisites: Undergraduate degree in a STEM field. Otherwise, there are no prerequisites for the course

Credit Restrictions: Students will receive no credit for ENGIN 291B after completing ENGIN 291B. A deficient grade in ENGIN 291B may be removed by taking ENGIN 291B.

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Summer: 5 weeks - 1 hour of lecture and 2.6 hours of discussion per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Sherburne, Gatto

ENGIN 295 Communications for Engineering Leaders 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
Engineering leadership principles integrated with concurrent technical capstone projects for Master of Engineering students. Students enroll in this supplementary course while they are enrolled in Engineering 296M, Capstone project, with their technical department capstone advisor. This project-based course will apply communication skills to the capstone project with a focus on presentations and writing in a professional context.
Rules & Requirements

Prerequisites: Admission to MEng program or College of Engineering PhD program

Repeat rules: Course may be repeated for credit up to a total of 2 times.

Hours & Format

Fall and/or spring:
2 weeks - 8 hours of lecture per week
7 weeks - 2 hours of lecture per week
8 weeks - 2 hours of lecture per week
10 weeks - 1.5 hours of lecture per week
15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructors: Bauer, Fitzpatrick, Halpern, Houlihan

ENGIN W295A Communications for Engineering Leaders 1 Unit

Terms offered: Prior to 2007
Professional communications for Master of Engineering students.
The course has two objectives: to develop and/or hone your individual communication skills, as you generate content supporting your career development [fall] and to further your individual and team-based communication skills, as your team generates content for your capstone reporting deliverables [spring].
Rules & Requirements

Prerequisites: Restricted to Master of Engineering degree students

Hours & Format

Fall and/or spring: 10 weeks - 0.5 hours of web-based lecture and 0.5 hours of tutorial per week

Online: This is an online course.

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Beliaev

ENGIN W295B Communications for Engineering Leaders 1 Unit

Terms offered: Prior to 2007
Professional communications for Master of Engineering students.
The course has two objectives: to develop and/or hone your individual communication skills, as you generate content supporting your career development [fall] and to further your individual and team-based communication skills, as your team generates content for your capstone reporting deliverables [spring].
Rules & Requirements

Prerequisites: Restricted to Master of Engineering degree students

Hours & Format

Fall and/or spring: 10 weeks - 0.4 hours of web-based lecture and 0.7 hours of workshop per week

Online: This is an online course.

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Beliaev

ENGIN 296MA Master of Engineering Capstone Project 1 - 12 Units

Terms offered: Fall 2021, Fall 2019, Fall 2018
This course is the first of a sequence of two capstone project courses for candidates of the Masters of Engineering degree. Students engage in professionally oriented independent or group research or study under the supervision of a research advisor. The research and study synthesizes the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organization.
Rules & Requirements

Prerequisites: Acceptance into the Master of Engineering program

Repeat rules: Course may be repeated for credit without restriction. Students may enroll in multiple sections of this course within the same semester.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade. This is part one of a year long series course. A provisional grade of IP (in progress) will be applied and later replaced with the final grade after completing part two of the series.

ENGIN 296MB Master of Engineering Capstone Project 1 - 5 Units

Terms offered: Spring 2025, Spring 2023, Spring 2022
This course is the second of a sequence of two capstone project courses for candidates of the Masters of Engineering degree. Students engage in professionally oriented independent or group research or study under the supervision of a research advisor. The research and study synthesizes the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organizations.
Rules & Requirements

Prerequisites: ENGIN 296MA

Hours & Format

Fall and/or spring: 15 weeks - 1-5 hours of seminar per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade. This is part two of a year long series course. Upon completion, the final grade will be applied to both parts of the series.

ENGIN 296MS Capstone Project 2 Units

Terms offered: Prior to 2007
This course is a Capstone Project class for candidates of the Master of Advanced Study in Engineering (MAS-E) degree. Students engage in a professionally-oriented independent research or study, under the supervision of a research advisor, with the goal of synthesizing the technical, environmental, economic, and social issues involved in the design and operation of complex engineering devices, systems, and organizations. Students will develop and demonstrate these synthesis skills through their engagement in a capstone project.
Objectives & Outcomes

Course Objectives: To engage students in a professionally-oriented independent research or study to integrate the technical dimensions of the Master of Advanced Study in Engineering.

Rules & Requirements

Prerequisites: Acceptance into the Master of Advanced Study in Engineering (MAS-E) program

Hours & Format

Fall and/or spring: 15 weeks - 6 hours of independent study per week

Summer: 12 weeks - 7.5 hours of independent study per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Zohdi

ENGIN 297 Introspective Leadership 2 Units

Terms offered: Spring 2025, Spring 2021
This course provides the framework for leadership development. The class focuses on development of self and emotional intelligence; identification of core values, creation of purpose statements; growth mind-set; ethical decision-making; inspiration of others, conflict resolution, goal setting and teamwork; global and cultural awareness; and development of plans of action. Weekly introspective reflections are required. The class comprises three parts: (I) Exploration of your leadership journey; (II) Discovery of your Personal Leadership Style; and (III) Development of a Personal Leadership Plan.

Objectives & Outcomes

Course Objectives: This course offers the requisite framework for personal leadership development. The course provides students with requisite skills for authentic leadership, self-discovery, team work, global awareness, ethical decision-making, service to society and creation of personal leadership plans.

Student Learning Outcomes: Students will learn how to assess personal strengths, identify core values requisite for ethical decision-making, ascertain skills to inspire others and navigate difficult conversations, enhance cultural awareness, implement plans of action and develop purpose statements.

Rules & Requirements

Credit Restrictions: Students will receive no credit for ENGIN 297 after completing ENGIN 297. A deficient grade in ENGIN 297 may be removed by taking ENGIN 297.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

Instructor: Pruitt

ENGIN 298 Fung Institute Engineering Leadership Speaker Series 1 Unit

Terms offered: Fall 2025, Fall 2024, Spring 2024
This lecture series serves as an inspirational supplement to Master of Engineering graduate curriculum in leadership and innovation. The course features insightful conversations with high-level industry speakers who share their experience with engineering leadership and innovation. Speakers draw from Silicon Valley leadership, Fung Institute capstone project partners and advisory board, MEng Alumni featured in Forbes 30 under 30 and Inc's Top 50 Young Entrepreneur's to watch.

Rules & Requirements

Prerequisites: Enrollment in the Master of Engineering program

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

ENGIN 298A Group Studies or Seminars 1 - 6 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
Advanced group studies or seminars in subjects which are interdisciplinary in the various fields of engineering or other sciences associated with engineering problems. Topics which form the basis of seminars will be announced at the beginning of each semester.

Rules & Requirements

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

Hours & Format

Fall and/or spring: 15 weeks - 1-6 hours of seminar per week

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Letter grade.

ENGIN 298B Group Studies or Seminars 1 - 6 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015
Advanced group studies or seminars in subjects which are interdisciplinary in the various fields or engineering or other sciences associated with engineering problems. Topics which form the basis of seminars will be announced at the beginning of each semester.

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.