SUSTAINABLE STANFORD

AC Credit 1: Academic Courses

Total Academic Courses: 4,672
Total Sustainability Courses: 182
Total Courses that Include Sustainability: 305

Class Number	Class Title	Units	Course Description
AA 100	Introduction to Aeronautics and Astronautics	3	The principles of fluid flow, flight, and propulsion; the creation of lift and drag, aerodynamic performance including takeoff, climb, range, and landing performance, structural concepts, propulsion systems, trajectories, and orbits. The history of aeronautics and astronautics.
AA 116N	Electric Automobiles and Aircraft	3	Transportation accounts for nearly one-third of American energy use and greenhouse gas emissions and three-quarters of American oil consumption. It has crucial impacts on climate change, air pollution, resource depletion, and national security. Students wishing to address these issues will need to reconsider how we move, finding sustainable transportation solutions. This course will provide an introduction to the issue, covering the past and present of transportation and its impacts; examining alternative fuel proposals; and digging deeper into the most promising option: battery electric vehicles. Energy requirements of air, ground, and maritime transportation; design of electric motors, power control systems, drive trains, and batteries; and technologies for generating renewable energy. Two fun opportunities for hands-on experiences with electric cars.
AA 236A	Spacecraft Design	3-5	The design of unmanned spacecraft and spacecraft subsystems emphasizing identification of design drivers and current design methods. Topics: spacecraft configuration design, mechanical design, structure and thermal subsystem design, attitude control, electric power, command and telemetry, and design integration and operations.
AA 236B	Spacecraft Design Laboratory	3	Continuation of 236A. Emphasis is on practical application of systems engineering to the life cycle program of spacecraft design, testing, launching, and operations.
AA 241A	Introduction to Aircraft Design, Synthesis, and Analysis	3	New aircraft systems emphasizing commercial aircraft. Economic and technological factors that create new aircraft markets. Determining market demands and system mission performance requirements; optimizing configuration to comply with requirements; the interaction of disciplines including aerodynamics, structures, propulsion, guidance, payload, ground support, and parametric studies. Applied aerodynamic and design concepts for use in configuration analysis. Application to a student-selected aeronautical system; applied structural fundamentals emphasizing fatigue and fail-safe considerations; design load determination; weight estimation; propulsion system performance; engine types; environmental problems; performance estimation. Direct/indirect operating costs prediction and interpretation. Aircraft functional systems; avionics; aircraft reliability and maintainability.

AA 241B	Introduction to Aircraft Design, Synthesis, and Analysis	3	New aircraft systems emphasizing commercial aircraft. Economic and technological factors that create new aircraft markets. Determining market demands and system mission performance requirements; optimizing configuration to comply with requirements; the interaction of disciplines including aerodynamics, structures, propulsion, guidance, payload, ground support, and parametric studies. Applied aerodynamic and design concepts for use in configuration analysis. Application to a student-selected aeronautical system; applied structural fundamentals emphasizing fatigue and fail-safe considerations; design load determination; weight estimation; propulsion system performance; engine types; environmental problems; performance estimation. Direct/indirect operating costs prediction and interpretation. Aircraft functional systems; avionics; aircraft reliability and maintainability.
AA 241X	Design, Construction, and Testing of Autonomous Aircraft	3	Students grouped according to their expertise to carry out the multidisciplinary design of a solar-powered autonomous aircraft that must meet a clearly stated set of design requirements. Design and construction of the airframe, integration with existing guidance, navigation, and control systems, and development and operation of the resulting design. Design reviews and reports.
AA 252	Techniques of Failure Analysis	3	Introduction to the field of failure analysis, including fire and explosion analysis, large scale catastrophe projects, traffic accident reconstruction, aircraft accident investigation, human factors, biomechanics and accidents, design defect cases, materials failures and metallurgical procedures, and structural failures. Product liability, failure modes and effects analysis, failure prevention, engineering ethics, and the engineer as expert witness.
AA 272C	Global Positioning Systems	3	The principles of satellite navigation using GPS. Positioning techniques using code tracking, single and dual frequency, carrier aiding, and use of differential GPS for improved accuracy and integrity. Use of differential carrier techniques for attitude determination and precision position determination.
AA 280	Smart Structures	3	Mechanics of smart materials and current approaches for engineering smart structures to monitor health, self heal, and adapt to environment. Definition of smart structures; constitutive models for smart materials; piezoelectric ceramics; electro-active polymers; shape memory alloys; bio-inspired materials and structures; self-healing materials; sensors and sensor networks; structural health monitoring; and energy harvesting.
AA 283	Aircraft and Rocket Propulsion	3	Introduction to the design and performance of airbreathing and rocket engines. Topics: the physical parameters used to characterize propulsion system performance; gas dynamics of nozzles and inlets; cycle analysis of ramjets, turbojets, turbofans, and turboprops; component matching and the compressor map; introduction to liquid and solid propellant rockets; multistage rockets; hybrid rockets; thermodynamics of reacting gases. Prerequisites: undergraduate background in fluid mechanics and thermodynamics.
AFRICAAM 150B	19th Century America	5	Territorial expansion, social change, and economic transformation. The causes and consequences of the Civil War. Topics include: urbanization and the market revolution; slavery and the Old South; sectional conflict; successes and failures of Reconstruction; and late 19th-century society and culture.

AFRICAAM 16N	African Americans and Social Movements	3	Theory and research on African Americans' roles in post-Civil Rights, US social movements. Topics include women's right, LGBT rights, environmental movement, and contemporary political conservativism.
AFRICAAM 204F	The Modern Tradition of Non-Violent Resistance	5	During the twentieth century, peasants and menial laborers who comprised the majority of humanity launched liberation movements to secure citizenship rights. Mohandas K. Gandhi, Martin Luther King, Jr., and Nelson Mandela are among the leaders whose ideas continue to influence contemporary movements for global peace with social justice in a sustainable environment.
AFRICAST 212	AIDS, Literacy, and Land: Foreign Aid and Development in Africa	5	Public policy issues, their roots, and the conflicts they engender. The policy making process: who participates, how, why, and with what results? Innovative approaches to contested policy issues. Foreign roles and their consequences. Case studies such as: a clinic in Uganda that addresses AIDS as a family and community problem; and strategies in Tanzania to increase girls' schooling.
AMSTUD 251C	The American Enlightenment	5	Eighteenth century America was like a laboratory for exciting new social, political, religious, scientific, and artistic theories that we collectively call "the Enlightenment." With readings in original texts and studies of material culture, examines ways in which eighteenth century Americans applied Enlightenment thinking to some of the most important problems and questions of their time. What was the best kind of government, and how could this be known? Was the new world of America fundamentally different or the same as Europe, and did animals, plants,and people improve or worsen there? What creatures (children, apes, women, slaves) were considered unreasonable in the Age of Reason, and why? What was the place of religion and passion in the Age of Reason?
ANTHRO 102	Urban Ethnography	5	Ethnographic research and writing focuses on the ways our lives are shaped by interacting forces such as history, political economy, and creative cultural practices. In the last fifty years, more and more cultural anthropology has been carried out in urban contexts, due to both urbanization around the world and changes in anthropology as a field. This seminar focuses on careful reading and analysis of book-length ethnographies about urban cultures, people and dynamics to consider what the theory and methodological tools of anthropology have to offer us as we seek to better understand "the city." Readings include a variety of approaches to ethnographic research in and/or about cities, with a mix from different eras and about different cities around the world.
ANTHRO 118	Heritage, Environment, and Sovereignty in Hawaii	4	This course explores the cultural, political economic, and environmental status of contemporary Hawaiians. What sorts of sustainable economic and environmental systems did Hawaiians use in prehistory? How was colonization of the Hawaiian Islands informed and shaped by American economic interests and the nascent imperialsm of the early 20th centrury? How was sovereignty and Native Hawaiian identity been shaped by these forces? How has tourism and the leisure industry affected the natural environment? This course uses archaeological methods, ethnohistorical sources, and historical analysis in an exploration of contemporary Hawaiian social economic and political life.

ANTHRO 200C	STS Senior Capstone: Genetics, Ethics, and Society	5	Genetics, Ethics and Society. This course will explore three socially transforming components of genetics research that hold simultaneously liberating and constraining possibilities for populations and publics, both locally and globally. Topically the course will be divided into three sections. First, we will examine past and present issues dealing with the study of human subjects, as well as recent proposals to eventually bring full genome scans to every individual (personal genomics). Next we will learn of large-scale projects that aim to map the presence of environmental pathogens by their genetic signatures on a planetary scale and how different global populations may be affected. The last section of the course will focus on still other projects and policies that aim to expand the scope and capacity of state and international law enforcement through DNA-based forensics (the FBI CODIS database and the UK's Human Provenance Pilot Project). Projects like the latter also overlap with theories about community, families, and citizens who may or may not be linked through DNA. New concepts, such as the forensic "genetic informant" within a family unit, human DNA and isotope "country matches" in cases of state asylum, and DNA based kinship rules for family reunification in many Western countries, will be explored. In all three sections we will also examine scientific ethics when subject populations are minorities, or somehow structurally disadvantaged globally.nn This capstone course will provide students with tools to explore and critically assess the various technical, social, and ethical positions of researchers, as well as the role of the state and certain publics in shaping scientific research agendas that promise to reorganize critical aspects of human life. Students will be encouraged to explore these dynamics within such important societal domains as health, law, markets of bio-surveillance, and the growing industry of disease and heritage DNA identity testing among others. We will read works from social scientists of science practice, ethicists, medial humanists and scientists. This course will equip students with tools to write about the intersection of science and society and to engage in a research project that relates to the topical foci of the course, broadly conceived.
ANTHRO 212	Public Archaeology: Market Street Chinatown Archaeology Project	4-5	This internship-style course centers on the practice and theory of historical archaeology research and interpretation through a focused study of San Jose's historic Chinese communities. The course includes classroom lectures, seminar discussion, laboratory analysis of historic artifacts, and participation in public archaeology events. Course themes include immigration, urbanization, material culture, landscape, transnational identities, race and ethnicity, gender, cultural resource management, public history, and heritage politics. The course includes required lab sections, field trips, and public service. Transportation will be provided for off-site activities.

ANTHRO 217	Acultural Animals as Proxies for Cultural Humans	5	The human-animal relationship is dynamic, all encompassing and durable. Without exception, all socio-cultural groups have evidenced complex interactions with the animals around them, both domesticated and wild. However, the individual circumstances of these interactions are hugely complicated, and involve much more than direct human-animal contact, going far beyond this to incorporate social, ecological and spiritual contexts. This course delves into this complexity, covering the gamut of social roles played by animals, as well as the methods and approaches to studying these, both traditional and scientific. While the notion of "animals as social actors" is well acknowledged, their use as proxies for human autecology (the relationship between a species and its environment) is also increasingly recognised as a viable mechanism for understanding our cultural and economic past. The module presents an overview covering a broad timespan from the Pleistocene to the modern day. It will piece together the breadth of human-animal relationships using a wide geographic range of case studies.
ANTHRO 219	Zooarchaeology: An Introduction to Faunal Remains	5	As regularly noted, whether historic or pre-historic, animal bones are often the most commonly occurring artefacts on archaeological sites. As bioarchaeological samples, they offer the archaeologist an insight into food culture, provisioning, trade and the social aspects of human-animal interactions. The course will be taught through both practical and lecture sessions: the "hands-on" component is an essential complement to the lectures. The lectures will offer grounding in the main methodological approaches developed, as well as provide case-studies to illustrate where and how the methods have been applied. The practical session will walk students through the skeletal anatomy of a range of species. It will guide students on the identification of different parts of the animal, how to age / sex individuals, as well as recognise taphonomic indicators and what these mean to reconstructing post-depositional modifications.
ANTHRO 225	Language and the Environment	3-4	Lecture course on vocabulary and grammar as keys to peoples' understanding and use of the environment. Ethnobotany, ethnobiology, and ethnosemantics in the analysis of the language of place, plants and animals, the earth, the body, and disease. Terminological gaps and gluts and what they imply. Language as a strategic resource in environmental management. Language contact and conflict in the modern global environment, with particular attention to the vocabularies of capitalism and property. Language extinction and its environmental implications.
ANTHRO 230B	Introduction to GIS in Anthropology	5	How GIS and spatial tools can be applied in social research. Case studies and student projects address questions of social and cultural relevance using real data sets, including the collection of geospatial data and building of spatial evidence. Analytical approaches and how they can shape a social and cultural interpretation of space and place.

ANTHRO 236	The Anthropology of Global Supply Chains	5	This upper-division undergraduate seminar focuses on recent studies by anthropologists and scholars in related disciplines on global supply chains and consumption practices.The goal of the course is to assess concepts and methods for integrating a cultural analysis of transnational production with a cultural analysis of transnational consumption. We will review ethnographic studies of the production and consumption of commodities linked by transnational and global networks. The class will then pursue collaborative research on the global production, distribution, and consumption of a selected commodity.
ANTHRO 247	Nature, Culture, Heritage	5	Seminar. Shared histories of natural and cultural heritage and their subsequent trajectories into the present. How thought about archaeological sites and natural landscapes have undergone transformations due to factors including indigenous rights, green politics, and international tourism. The development of key ideas including conservation, wilderness, sustainability, indigenous knowledge, non-renewability and diversity. Case studies draw on cultural and natural sites from Africa, the Americas and Australia.
ANTHRO 249	South Asia: History, People, Politics	5	The South Asian subcontinent (comprising of India, Pakistan, Bangladesh, Nepal, Bhutan and Sri Lanka) is one of the most diverse and densely populated regions in the world and increasingly prominent in new global political and cultural economies. South Asia has also provided the inspiration for cutting edge theories about the colonial state, postcolonial studies, democracy, popular culture, and religious conflict. The course will provide an overview of major historical events and social trends in contemporary South Asia and focus on themes such as gender, religion, caste, migration and movement, new technologies, the urban and rural, the state, and new forms of consumption among others. Thus, the course will give students historically and theoretically informed perspectives on contemporary South Asia, as well as how to apply insights learned to larger debates within the political and social sciences.
ANTHRO 255	Research Methods in Ecological Anthropology	3-5	The course prepare students for the methodological and practical aspects of doing ecologically oriented, quantitative anthropological field research. The primary goal is to explore what it means to ask anthropological questions in a systematic way. We will focus on understanding what can constitute an interesting question, how to frame a question in way that facilitates investigation, and how to design methods to begin investigating a question. In turn, the course will provide a format to refine research projects in preparation for doing more extensive fieldwork.
ANTHRO 261A	Human Ecology: Adaptations to Climate and Climate Change	5	Humans face essentially the same adaptive challenges as all organisms but are unique for having successfully adapted to virtually every environment on Earth. The resulting diversity of phenotypes and cultures' past and present is key to understanding how interactions with environments shape the economic, social, and cultural lives of hunter-gatherers, pastoralists and agriculturalists. This course surveys the range of human adaptations from an ecological and evolutionary perspective to understand human adaptive capacity and vulnerability to climate change.

ANTHRO 262	Indigenous Peoples and Environmental Problems	3-5	The social and cultural consequences of contemporary environmental problems. The impact of market economies, development efforts, and conservation projects on indigenous peoples, emphasizing Latin America. The role of indigenous grass roots organizations in combating environmental destruction and degradation of homeland areas.
ANTHRO 269	The Ecology of Cuisine: Food, Nutrition, and the Evolution of the Human Diet	3-5	This course is an interdisciplinary approach to understanding human food consumption and nutrition, incorporating biological, evolutionary, ecological and social perspectives. Topics include a broad survey of primate diets and their physiological and behavioral correlates; fossil and archaeological evidence for early human diets; adaptations to dietary shifts since the Neolithic; infant and early child feeding practices and their role in shaping human social arrangements, metabolic syndrome, food security, food taboos; the origins of spices; cultural diversity in the social uses and meanings of food and the sharing of food; gathering, hunting and locavorism as high hipster cuisine. Emphasis is on understanding the diversity of human foodways through time and space: how biology, culture, and ecology interact to shape the food we eat, and how the food we eat shapes us.
ANTHRO 302	History of Anthropological Theory, Ecology, and Environment	5	Evolutionary and ecological theory from the 19th century to present. Theory and concepts from evolution and ecology, emphasizing an-thropological applications. Evolutionary theories of human behavior, culture, and societies. Ecological theory behind carrying capacity, sustainable yield, and population growth. Emphasis is on tools of analysis and formulating research questions in anthropology today. Upper division undergrads require consent of instructor.
ANTHRO 355	Cities in Global Perspective	5	Interdisciplinary approach to examining global cities. The concept of the global city, and the interdependent processes that help produce urban spaces. Situating the transformation of urban spaces within globalization and its differential effects; current explanatory frameworks that pay attention to multiple scales of spatial and economic articulation.
ANTHRO 367	The Anthropology of Science: Global Politics and Laboratory Life	5	Science and technology are important cultural products that often dramatically reorganize various aspects of human life. In this course we will explore how recent innovations in the life sciences and biomedicine may reconfigure crucial elements of social institutions, lend new structures to identity politics, and often change the way we interact with and conceive of nature. We will examine these issues in various global settings to explore how everyday politics shape politics of life in different locales.
ANTHRO 373	Things: An Archaeology of the Relationships Between Humans and Things	5	This course examines a variety of approaches that claim to explore the relationships between humans and things. Some of the approaches include Marx and material culture studies; Heidegger; cognitive and phenomenological; Actor Network Theory. But there is a need also to examine behavioral and ecological and Darwinian approaches. Many of these approaches do not adequately deal with the physicality of things as objects and there is a need to seek a way to incorporate such aspects of things into social theory.

ANTHRO 55A	Introduction to Archaeobotany	5	The aim of this course is to provide a short introduction to archaeobotany. An overview of types of archaeobotanical remains will include an examination of macrobotanical remains (seeds, charcoal), microfossil remains (starch, pollen, phytoliths) and molecular remains (aDNA, isotopes). The ways in which various types of plant remains have been used will be discussed through case studies. Major debates that archaeobotanical research has shed light on, including the origins of agriculture and issues around domestication will also be examined. Some practical work will allow students to gain familiarity with botanical nomenclature and some archaeobotanical protocols and plant identification techniques. Students will look at microfossil residues from local grinding slabs and write a short paper on the residues recovered. They will also look at seed remains from either Chinese or local flotation samples using microscopes in the lab.
ANTHRO 90C	Theory of Ecological and Environmental Anthropology	5	Dynamics of culturally inherited human behavior and its relationship to social and physical environments. Topics include a history of ecological approaches in anthropology, subsistence ecology, sharing, risk management, territoriality, warfare, and resource conservation and management. Case studies from Australia, Melanesia, Africa, and S. America.
APPPHYS 205	Introduction to Biophysics	3-4	Core course appropriate for advanced undergraduate students and graduate students with prior knowledge of calculus and a college physics course. Introduction to how physical principles offer insights into modern biology, with regard to the structural, dynamical, and functional organization of biological systems. Topics include the roles of free energy, diffusion, electromotive forces, non-equilibrium dynamics, and information in fundamental biological processes.
APPPHYS 236	Biology by the Numbers: Evolution	3	Topics in biology from a quantitative perspective. Subjects vary. 2012-13 focus: evolution, from basic principles of evolutionary dynamics to fundamental quantitative questions that are far from being answered; from early life, metabolic processes, and molding of earth by microbes to spread of human epidemics; from analysis of genomes and molecular phylogenies to aspects of multi-cellular development. Prerequisite: familiarity with ordinary differential equations and probability. Biology background not required.
APPPHYS 79N	Energy Options for the 21st Century	3	Preference to freshmen. Choices for meeting the future energy needs of the U.S. and the world. Basic physics of energy sources, technologies that might be employed, and related public policy issues. Trade-offs and societal impacts of different energy sources. Policy options for making rational choices for a sustainable world energy economy.
ARCHLGY 224	Archaeology of Food: production, consumption, and ritual	3-5	This course explores many aspects of food in human history from an archaeological perspective. We will discuss how the origins of agriculture helped to transform human society; how food and feasting played a prominent role in the emergence of social hierarchies and the development of civilization; and how various foodways influenced particular cultures. We will also conduct experimental studies to understand how certain methods of food procurement, preparation, and consumption can be recovered archaeologically.

ARTHIST 232Q	Place: Making Space Now	3	This seminar argues that architeccts are ultimately "placemakers," and questions what that means in the contemporary world. Part I investigates the meaning of the word "place." Additional background for understanding contemporary place making will include a critique of the history of modern place-making through an examination of modern form. Part II examines two traditional notions of place by scale: from "home" to "the city." What elements give these conceptions of space a sense of place? To answer this question, themes such as memory, mapping, and boundary, among others, will be investigated. part III presents challenges to the traditional notions of place discussed in Part II. Topics addressed include: What does it mean to be "out of place?" What sense of place does a nomad have, and how is this represented? What are the "non-places" and how can architects design for these spaces? Part IV addresses the need to re-conceptualize contemporary space. The role of digital and cyber technologies, the construction of locality in a global world, and the in-between places that result from a world in flux are topics discussed in this section of the seminar. nLearning goals: Specific goals include clsoe reading of texts, understanding of philosophical thinking and writing, argument under uncertainty, and developed concepts of place, space and architecture.
ARTHIST 359	American Photographs, 1839-1971: A Cultural History	4	This course concentrates on many important American photographers, from the era of daguerreotypes to near the end of the pre-digital era. We study photographs of the Civil War, western exploration, artistic subjects, urban and rural poverty, skyscrapers, crime, fashion, national parks, and social protest, among other topics. Among the photographers we study: Carleton Watkins, Eadweard Muybridge, Walker Evans, Dorothea Lange, Garry Winogrand, and Diane Arbus. Emphasis on developing students' abilities to discuss and write about photography; to see it.
ARTSTUDI 284	Art and Biology	4	The relationship between biology and art. Rather than how art has assisted the biological sciences as in medical illustration, focus is on how biology has influenced art making practice. New technologies and experimental directions, historical shifts in artists' relationship to the living world, the effects of research methods on the development of theory, and changing conceptions of biology and life. Projects address these themes and others that emerge from class discussions and presentations.
ASNAMST 295F	Race and Ethnicity in East Asia	4-5	Historical, cultural, political and theoretical perspectives. Commonly misunderstood as an ethnically homogeneous country, the People's Republic of China is home to 55 officially recognized minority groups, many of whom inhabit the strategic border regions of the country. How similar assumptions of ethnic and racial homogeneity in Taiwan, Japan, and Korea are being reexamined by scholars in disciplines including anthropology, history, and political science.

ATHLETIC 405	Outdoor Leadership	1	Outdoor Leadership 1 : Develop leadership skills necessary to lead multi-day backpacking trips for inexperienced participants. Course is taught through a combination of discussions and experiential activities and introduction to theory. Topics include: adventure learning, group dynamics, outdoor risk management, evacuations, faciliation. This course is required for those interested in leading Stanford Pre-Orientation Trips (SPOT), but is also open to interested students with other outdoor leadership goals.
ATHLETIC 415	Outdoor Leadership 2	1	Outdoor Leadership 2: This course will build the logistical and leadership skills needed for the effective design and delivery of mulit-day outdoor trips. Students will learn the fundamentals of: route planning based on group size and skill; backcountry menu development and ration packaging; backcountry risk management and emergency action plans; theory behind evaluation and management of physical, emotional and perceived risk; execution of search, evacuation and emergency procedures; fundamentals of sound judgement and decision making.
ATHLETIC 510	Wilderness First Aid	1	Wilderness First Aid (WFA) is a class that provides a basic introduction to backcountry and emergency medicine. Topics covered include patient assessment, addressing life threats, shock, spine safety, musculoskeletal injuries, medical emergencies, environmental emergencies, and more. Each weekly class short lectures and practical sessions. A 3-year certification card is provided by Stanford Wilderness Medicine (SWiM) upon successful completion of the course.
ATHLETIC 515	Wilderness Firs Responder	2	Wilderness First Responder (WFR) is an intensive 80 hour class that focuses on basic life support techniques and tools for the outdoor professional working in the wilderness. It covers trauma, environmental and medical issues that arise in a wilderness setting using both lecture and hands-on activity of scenarios and labs for experiential education. Among other things, students will perform solid CPR and BLS skills, make improvised splints, understand basic anatomy and physiology, clean and manage wounds in the back-country, recognize serious back-country trauma injuries, environmental issues, medical issues, triage and know how to handle mass casualty incidents. Wilderness First Responder is a must for outdoor professionals looking to take their first aid skills to the next level, and to be prepared for medical emergencies in the wilderness. WFR certification lasts 3 years upon successful passing of written and practical exams. Course includes AEHS adult, child, and infant CPR certification which is OSHA approved.
BIO 101	Ecology	4	The principles of ecology. Topics: interactions of organisms with their environment, dynamics of populations, species interactions, structure and dynamics of ecological communities, biodiversity. Half-day field trip required.
BIO 102	Deomography: Health, Development, Environment	3	Demographic methods and their application to understanding and projecting changes in human infant, child, and adult mortality and health, fertility, population, sex ratios, and demographic transitions. Progress in human development, capabilities, and freedoms. Relationships between population and environment.

BIO 10SC	Natural History, Marine Biology, and Research	2	Monterey Bay is home to the nation's largest marine sanctuary and also home to Stanford's Hopkins Marine Station. This course, based at Hopkins, explores the spectacular biology of Monterey Bay and the artistic and political history of the region. The course focuses on issues of conservation, sanctuary, and stewardship of the oceans and coastal lands. We will meet with conservationists, filmmakers, artists, authors, environmentalists, politicians, land-use planners, and lawyers, as well as scientists and educators, to learn what is being done to appreciate, protect, and study the coastline and near-shore waters at local and national levels. We will take a look at the discipline of marine biology to discover the range of topics and methods of research it embraces and to help define some of the larger issues in biology that loom in our future. The course emphasizes interactions and discussions between individuals, groups, and our guests; it is a total immersion experience.
BIO 12N	Sensory Ecology of Marine Animals	3	Animals living in the oceans experience a highly varied range of environmental stimuli. An aquatic lifestyle requires an equally rich range of sensory adaptations, including some that are totally foreign to us. In this course we will examine sensory system in marine animals from both an environmental and behavioral perspective and from the point of view of neuroscience and information systems engineering.
BIO 139	Biology of Birds	3	How birds interact with their environments and each other, emphasizing studies that had impact in the fields of population biology, community ecology, and evolution. Local bird communities. Emphasis is on field research.
BIO 146	Population Studies	1	Series of talks by distinguished speakers introducing approaches to population and resource studies.
BIO 15N	Environmental Literacy	3	Preference to freshmen. Lack of public understanding of the details of most environmental problems is cited as a cause of environmental deterioration. Good citizenship requires literacy about the elements of the scientific and decision making processes that accompany most environmental issues: what can happen, what are the odds, how can the credibility of sources of expertise be assessed, which components of environmental debates deal with factual and theoretical issues, and which are political value judgments?
BIO 22N	Infection, Immunity, and Global Health	3	Why do infectious diseases continue to challenge us despite advances in medicine? This course will explore the causes and prevention of infectious diseases, focusing on the interplay between pathogens, the immune system, the environment, and societal factors that affect disease occurrence and outcomes. Topics will include: basic elements of microbiology, immunology, and epidemiology; case studies of old diseases (e.g., smallpox, tuberculosis, malaria) and recently-emergent diseases (e.g., Ebola, AIDS, antibiotic-resistant bacteria, Lyme disease, and pandemic influenza) that illustrate the biological, environmental, cultural, political, and economic factors that affect disease emergence, spread, and control; the limitations of modern medical approaches such as antibiotics and vaccines; and strategies for reducing global infectious disease threats. The seminar will feature class discussion, student projects, and faculty and student presentations.

BIO 282	Modeling Cultural Evolution	3	Seminar. Quantitative models for the evolution of socially transmitted traits. Rates of change of learned traits in populations and patterns of cultural diversity as a function of innovation and cultural transmission. Learning in constant and changing environments. Possible avenues for gene-culture coevolution.
BIO 288	Biochemistry I	3	Chemistry of major families of biomolecules including proteins, nucleic acids, carbohydrates, lipids, and cofactors. Structural and mechanistic analysis of properties of proteins including molecular recognition, catalysis, signal transduction, membrane transport, and harvesting of energy from light. Molecular evolution.
BIO 3	Frontiers in Marine Biology	1	An introduction to contemporary research in marine biology, including ecology, conservation biology, environmental toxicology, behavior, biomechanics, evolution, neurobiology, and molecular biology. Emphasis is on new discoveries and the technologies used to make them. Weekly lectures by faculty from the Hopkins Marine Station.
BIO 302	Current Topics and Concepts in Population Biology, Ecology and Evolution	1	Required of first-year PhD students in population biology, and ecology and evolution. Major conceptual issues and developing topics.
BIO 303	Current Topics and Concepts in Population Biology, Ecology, and Evolution	1	Required of first-year PhD students in population biology, and ecology and evolution. Major conceptual issues and developing topics.
BIO 304	Current Topics and Concepts in Population Biology, Ecology, and Evolution	1	Required of first-year PhD students in population biology, and ecology and evolution. Major conceptual issues and developing topics.
BIO 30N	Extinctions in Near Time: Biodiversity Loss since the Pleistocene	3	The transition 11,700 years ago from the Pleistocene glacial period into the Holocene interglacial witnessed the expansion of humans around the world, climatic warming and the demise of many large vertebrate species. Since that time extinctions have continued on land and in the sea, culminating with the biodiversity crisis we are experiencing today. We will explore these prehistoric extinctions: "Who? When? Where? and Why?" in order to learn more about our planet's future.
BIO 312	Ethical Issues in Ecology and Evolutionary Biology	1	Focus is on ethical issues addressed in Donald Kennedy's *Academic Duty* and others of importance to academics and scientists in the fields of ecology, behavior, and evolutionary biology. Discussions led by faculty and outside guests. Satisfies ethics course requirement for ecology and evolutionary biology.
BIO 326	Foundations in Biogeography	2	Seminar. Focus on classic papers covering the global distribution and abundance of organisms through time. Topics include: phylogenetics, phylogeography, plate tectonics, island biogeography, climatic change, dispersal, vicariance, ecology of invasions, extinction, gradients, diversity, conservation and a history of the field.
BIO 390	Topics in Biology	1	Seminar. Topics in biology ranging from neurobiology to ecology.
BIO 43	Plant Biology, Evolution, and Ecology	5	Principles of evolution: macro- and microevolution and population genetics. Ecology: the principles underlying the exchanges of mass and energy between organisms and their environments; population, community, and ecosystem ecology; populations, evolution, and global change.

BIO 7N	Introduction to Conservation Photography	3	Introduction to the field of conservation photography and the strategic use of visual communication in addressing issues concerning the environment and conservation. Students will be introduced to basic digital photography, digital image processing, and the theory and application of photographic techniques. Case studies of conservation issues will be examined through photographs and multimedia platforms including images, video, and audio. Lectures, tutorials, demonstrations, and mandatory field trips will culminate in the production of individual and group projects.
BIOC 459	Frontiers in Interdisciplinary Biosciences	1	Three seminars per quarter address scientific and technical themes related to interdisciplinary approaches in bioengineering, medicine, and the chemical, physical, and biological sciences. Leading investigators from Stanford and the world present breakthroughs and endeavors that cut across core disciplines. Pre-seminars introduce basic concepts and background for non-experts.
BIOE 131	Ethics in Bioengineering	3	Bioengineering focuses on the development and application of new technologies in the biology and medicine. These technologies often have powerful effects on living systems at the microscopic and macroscopic level. They can provide great benefit to society, but they also can be used in dangerous or damaging ways. These effects may be positive or negative, and so it is critical that bioengineers understand the basic principles of ethics when thinking about how the technologies they develop can and should be applied. On a personal level, every bioengineer should understand the basic principles of ethical behavior in the professional setting. This course will involve substantial writing, and will use case-study methodology to introduce both societal and personal ethical principles, with a focus on practical applications.
BIOE 141A	Biodesign Project I	4	Team-based experience in biological and biomedical nntechnology design including need validation, design, initial prototyping, analysis and nnquantitative testing. This course is open only to students in the undergraduate Bioengineering program.
BIOE 141B	Biodesign Project II	4	Second of two quarter series. Team-based experience in biological and biomedical nntechnology design including need validation, design, initial prototyping, analysis and nnquantitative testing. This course is open only to students in the undergraduate Bioengineering program.

BIOE 273	Biodesign for Mobile Health	1	Examines the emerging Mobile Health industry. Mobile health (mHealth, or, wireless health) is the provision of health services and information via mobile technologies such as mobile phones and wearable sensors. Innovations in this area promise solutions to the need for universal access to affordable and effective health care by enabling consumers to take charge of their health, creating affordable ways to manage aging and chronic conditions, moving care from the hospital into the home, improving treatment options by providing transparency of measurable clinical outcomes, and shifting the focus from sick care to health improvement and prevention. Topics include the driving needs, applications, challenges and incentives that characterize the emerging mobile health landscape, and include an overview of some of the devices and companies that are already transforming the way health care is accesed today. Faculty and guest speakers discuss the status of the industry and research in Mobile Health, as well as opportunities in and challenges to medical technology innovation unique to this area. Issues related to Key Markets/Applications, Consumer/Enterprise Innovation, Policy/Regulatory, Financing, Business Models, Global Initiatives and Entrepreneurship are covered.
BIOE 371	Global Biodesign: Medical Technology in an International Context	1-2	Seminar examines the development and commercialization of medical technologies in the global setting focusing primarily on Europe, India and China. Faculty and guest speakers from industry and government discuss the status of the industry, as well as opportunities in and challenges to medical technology innovation unique to each geography. Topics related to development of technologies for bottom of the pyramid markets are also addressed.
BIOE 390	Introduction to Bioengineering Research	2	Preference to medical and bioengineering graduate students with first preference given to Bioengineering Scholarly Concentration medical students. Bioengineering is an interdisciplinary field that leverages the disciplines of biology, medicine, and engineering to understand living systems, and engineer biological systems and improve engineering designs and human and environmental health. Students and faculty will make presentations during the course. Students will be expected to make presentations, complete a short paper, read selected articles, and take quizzes on the material.
BIOE 393	Bioengineering Departmental Research Colloquium	1	Bioengineering department labs at Stanford present recent research projects and results. Guest lecturers. Topics include applications of engineering to biology, medicine, biotechnology, and medical technology, including biodesign and devices, molecular and cellular engineering, regenerative medicine and tissue engineering, biomedical imaging, and biomedical computation.
BIOE 450	Advances in Biotechnology	3	Guest academic and industrial speakers. Latest developments in fields such as bioenergy, green process technology, production of industrial chemicals from renewable resources, protein pharmaceutical production, industrial enzyme production, stem cell applications, medical diagnostics, and medical imaging. Biotechnology ethics, business and patenting issues, and entrepreneurship in biotechnology.

BIOHOPK 181H	Physiology of Global Change	4	Global change is leading to significant alterations in several environmental factors, including temperature, ocean acidity and oxygen availability. This course focuses on: (i) how these environmental changes lead to physiological stress and (ii) how, and to what extent, are organisms able to adapt through short-term acclimatization and evolutionary adaptation to cope with these stresses. A major focus of the class is to link changes in species' distribution patterns with underlying physiological mechanics that establish environmental optima and tolerance limits.
BIOHOPK 263H	Oceanic Biology	4	How the physics and chemistry of the oceanic environment affect marine plants and animals. Topics: seawater and ocean circulation, separation of light and nutrients in the two-layered ocean, oceanic food webs and trophic interactions, oceanic environments, biogeography, and global change. Lectures, discussion, and field trips.
BIOHOPK 272H	Marine Ecology	5	Course provides key concepts in ecology , familiarizes students with local marine ecosystems, the methods used in ecological studies of these ecosystems, and the analysis and interpretation of ecological data. Students will engage in presentation and debates of current topics in marine ecology and conservation.
BIOHOPK 273H	Marine Conservation Ecology	1	Introduction to the key concepts of ecology and policy relevant to marine conservation issues at the population to ecosystems level. Focus on the origin and maintenance of biodiversity and conservation applications from both the biology and policy perspectives (for example, endangered species, captive breeding, reserve design, habitat fragmentation, ecosystem restoration/rehabilitation). Also includes emerging approaches such as ecosystem based management, ocean planning, and coupled social-ecological systems. The course will include lectures, readings and discussions of primary literature, and attendance at seminars with visiting scholars.
BIOHOPK 277H	Dynamics and Management of Marine Populations	4	Course examines the ecological factors and processes that control natural and harvested marine populations. Course emphasizes mathematical models as tools to assess the dynamics of populations and to derive projections of their demographic fate under different management scenarios. Course objectives will be met by a combination of theoretical lectures, assigned readings and class discussions, case study analysis and interactive computer sessions.
BIOHOPK 280	Short Course on Ocean Policy	3	The course will introduce graduate students in the natural and social sciences to ocean policy and governance in the US at national, regional, state, and local levels. Together with leaders in ocean science and policy, students will examine pressing issues in ocean sustainability from natural science, social science, and legal and policy perspectives, with an emphasis on the role of science in the policy and governance processes. Students will learn and apply practical skills in communication, leadership and interdisciplinary problem-solving through participation in a group project, interactive discussions and simulations, and field trips.

BIOHOPK 287H	Sensory Ecology of Marine Animals	4	Topics: the ways animals receive, filter, and process information gleaned from the environment, sensory receptor mechanisms, neural processing, specialization to life underwater, communication within and between species, importance of behavior to ecosystem structure and dynamics, impact of acoustic and light pollution on marine animals. Emphasis is on the current scientific literature. The laboratory portion of the class explores sensory mechanisms using neurobiological methods and methods of experimental animal behavior.
BIOS 221	Modern Statistics for Modern Biology	3	Application based course in nonparametric statistics. Modern toolbox of visualization and statistical methods for the analysis of data, examples drawn from immunology, microbiology, cancer research and ecology. Methods covered include multivariate methods (PCA and extensions), sparse representations (trees, networks, contingency tables) as well as nonparametric testing (Bootstrap, permutation and Monte Carlo methods). Hands on, use R and cover many Bioconductor packages.
CEE 10	Introduction to the Civil and Environmental Engineering Professions	1	Open to freshman and sophomores; limited enrollment. Overview of undergraduate majors and possible career paths in Civil Engineering, Environmental Engineering, Atmosphere/Energy, and Architectural Design. Panel discussions with current undergraduate majors, and with alums. Hands-on activities with faculty in CEE. For students with interest areas such as water resources, environmental biotechnologies, sustainability, architecture, infrastructure planning, global warming, green energy, structures, and construction.
CEE 100	Managing Sustainable Building Projects	4	Managing the life cycle of buildings from the owner, designer, and contractor perspectives emphasizing sustainability goals; methods to define, communicate, coordinate, and manage multidisciplinary project objectives including scope, quality, life cycle cost and value, schedule, safety, energy, and social concerns; roles, responsibilities, and risks for project participants; virtual design and construction methods for product, organization, and process modeling; lifecycle assessment methods; individual writing assignment related to a real world project.
CEE 101B	Mechanics of Fluids	4	Physical properties of fluids and their effect on flow behavior; equations of motion for incompressible ideal flow, including the special case of hydrostatics; continuity, energy, and momentum principles; control volume analysis; laminar and turbulent flows; internal and external flows in specific engineering applications including pipes, open channels, estuaries, and wind turbines.
CEE 102	Legal Aspects of Engineering and Construction	3	Introduction to the U.S. legal system as it applies to civil engineering and construction. Fundamental concepts of contract and tort law, claims, risk management, business formation and licensing, agency, insurance and bonding, and real property.
CEE 122B	Compter Integrated A/E/C	2	Undergraduates serve as apprentices to graduate students in the AEC global project teams in CEE 222B. Project activity focuses on modeling, simulation, life-cycle cost, and cost benefit analysis in the project development phase.

CEE 155	Introduction to Sensing networks for CEE	4	Introduce the design and implementation of sensor networks for monitoring the built and natural environment. Emphasis on the integration of modern sensor and communication technologies, signal processing and statistical models for network data analysis and interpretation to create practical deployments to enable sustainable systems, in areas such as energy, weather, transportation and buildings. Students will be involved in a practical project that may involve deploying a small sensor system, data models and analysis and signal processing.
CEE 171	Environmental Planning Methods	3	For juniors and seniors. Use of microeconomics and mathematical optimization theory in the design of environmental regulatory programs; tradeoffs between equity and efficiency in designing regulations; techniques for predicting adverse effects in environmental impact assessments; information disclosure requirements; and voluntary compliance of firms with international regulating norms.
CEE 172	Air Quality Management	2-3	Quantitative introduction to the engineering methods used to study and seek solutions to current air quality problems. Topics: global atmospheric changes, urban sources of air pollution, indoor air quality problems, design and efficiencies of pollution control devices, and engineering strategies for managing air quality.
CEE 176A	Energy Efficient Buildings	3-4	Analysis and design. Thermal analysis of building envelope, heating and cooling requirements, HVAC, and building integrated PV systems. Emphasis is on residential passive solar design and solar water heating. Lab.
CEE 176B	Electric Power: Renewables and Efficiency	3-4	Renewable and efficient electric power systems emphasizing analysis and sizing of photovoltaic arrays and wind turbines. Basic electric power generation, transmission and distribution, distributed generation, combined heat and power, fuel cells. End use demand, including lighting and motors. Lab.
CEE 177	Aquatic Chemistry and Biology	4	Introduction to chemical and biological processes in the aqueous environment. Basic aqueous equilibria; the structure, behavior, and fate of major classes of chemicals that dissolve in water; redox reactions; the biochemistry of aquatic microbial life; and biogeochemical processes that govern the fate of nutrients and metals in the environment and in engineered systems.
CEE 179C	Environmental Engineering Design	5	Application of engineering fundamentals including environmental engineering, hydrology, and engineering economy to a design problem.
CEE 183	Integrated Civil Engineering Design Project	4	Studio format. Design concepts for civil engineering facilities from schematic design through construction, taking into account sustainable engineering issues. Design exercises culminating in the design of a civil engineering facility, emphasizing structural systems and materials and integration with construction and other project requirements.
CEE 206	Decision Analysis for Civil and Environmental Engineers	3	Current challenges in selecting an appropriate site, alternate design, or retrofit strategy based on environmental, economic, and social factors can be best addressed through applications of decision science. Basics of decision theory, including development of decision trees with discrete and continuous random variables, expected value decision making, utility theory value of information, and elementary multi-attribute decision making will be covered in the class. Examples will cover many areas of civil and environmental engineering problems.

CEE 207A	Energy Resources	4-5	Comprehensive overview of fossil and renewable energy resources and energy efficiency. Topics covered for each resource: resource abundance, location, recovery, conversion, consumption, end-uses, environmental impacts, economics, policy, and technology. Applied lectures in specific energy sectors: buildings, transportation, the electricity industry, and energy in the developing world. Required field trips to local energy facilities.
CEE 217	Renewable Energy Infrastructure	3	Construction of renewable energy infrastructure: geothermal, solar thermal, solar photovoltaic, wind, biomass. Construction and engineering challenges and related issues and drivers for performance, cost, and environmental impact. Context of renewable energy infrastructure development including comparison of the types of renewable energy, key economic, environmental, and social contextual factors, applicability of a type of renewable energy given a context, related barriers and opportunities. Class project to plan a start-up for developing a type of energy infrastructure based on an engineering innovation.
CEE 221A	Planning Tools and Methods in the Power Sector	3	This course covers the planning methods most commonly used in the power sector today. It covers both the fundamental methods used and their applications to electricity generation, transmission and distribution planning, integrated resource planning using both energy efficiency and renewable resources as well as utility finance and ratemaking. The methods covered will include forecasting (time series, regression and the use of markets), resource assessment (including energy efficiency and demand-side management) optimization (in power markets operation and in expansion planning) and the processes used in decision-making.
CEE 222A	Computer Integrated Architecture/Engineering/Construction (AEC) Global Teamwork	3	AEC students engage in a crossdisciplinary, collaborative, geographically distributed, and multicultural project-based teamwork. AEC teams exercise their domain knowledge and information technologies in a multidisciplinary context focusing on the design and construction concept development phase of a comprehensive building project.
CEE 222B	Computer Integrated Architecture/Engineering/Construction (AEC) Global Teamwork	2	Global AEC student teams continue their project activity focusing on the most challenging concept developed in 222A and chosen jointly with their client. Comprehensive team project focusing on design and construction, including: project development and documentation; detailing, 3D and 4D modeling, simulation, sustainable concepts, cost benefit analysis, and life-cycle cost analysis; and final project presentation of product and process.
CEE 224A	Sustainable Development Studio	1-5	Project-based. Sustainable design, development, use and evolution of buildings; connections of building systems to broader resource systems. Areas include architecture, structure, materials, energy, water, air, landscape, and food. Projects use a cradle-to-cradle approach focusing on technical and biological nutrient cycles and information and knowledge generation and organization.

CEE 226	Life Cycle Assessment for Complex Systems	3-4	Life cycle modeling of products, industrial processes, and infrastructure/building systems; material and energy balances for large interdependent systems; environmental accounting; and life cycle costing. These methods, based on ISO 14000 standards, are used to examine emerging technologies, such as biobased products, building materials, building integrated photovoltaics, and alternative design strategies, such as remanufacturing, dematerialization, LEED, and Design for Environment: DfE. Student teams complete a life cycle assessment of a product or system chosen from industry.
CEE 226E	Advanced Topics in Integrated, Energy-Efficient Building Design	2-3	Innovative methods and systems for the integrated design and evaluation of energy efficient buildings. Guest practitioners and researchers in energy efficient buildings. Student initiated final project.
CEE 227	Global Project Finance	3-5	Public and private sources of finance for large, complex, capital-intensive projects in developed and developing countries. Benefits and disadvantages, major participants, risk sharing, and challenges of project finance in emerging markets. Financial, economic, political, cultural, and technological elements that affect project structures, processes, and outcomes. Case studies.
CEE 229	Climate Change Adaptation for Seaports: Engineering and Policy for a Sustainable Future	3	Interdisciplinary. Exploration of impacts of climate change on coastal ports and harbors around the world. The research team will utilize a broad range of tools to assess the engineering, construction, and policy responses necessary to protect ports and harbors from significant sea-level rise and storm surge. Collaborations with national and international experts. Consideration of economic, social and environmental implications. Independent and team projects will contribute to ongoing research. Guest speakers, case studies and field trips.
CEE 234B	Intermediate Arch Studio	4	This studio offers students experience in working with a real site and a real client program to develop a community facility. Students will develop site analysis, review a program for development and ultimately design their own solutions that meet client and community goals. Sustainability, historic preservation, community needs and materials will all play a part in the development of students final project. Students will also gain an understanding of graphic conventions, verbal and presentation techniques
CEE 241A	Infrastructure Project Development	3	Infrastructure is critical to the economy, global competitiveness and quality of life. Topics include energy, transportation, water, public facilities, and communications sectors. Analysis of the condition of the nation's infrastructure and how projects are planned and financed. Focus is on public works in the U.S. The role of public and private sectors through a step-by-step study of the project development process. Case studies of real infrastructure projects. Industry guest speakers. Student teams prepare project environmental impact statements.
CEE 241B	Infrastructure Project Delivery	3	Infrastructure is critical to the economy, global competitiveness and quality of life. Topics include energy, transportation, water, public facilities ,and communications sectors. Analysis of how projects are designed, constructed, operated, and maintained. Focus is on public works projects in the U.S. Alternative project delivery approaches and organizational strategies. Case studies of real infrastructure projects. Industry guest speakers. Student teams prepare finance/design/build/operate/maintain project proposals.

CEE 241C	Global Infrastructure Projects Seminar	1-2	Real infrastructure projects presented by industry guest speakers. Energy, transportation, water, public facilities and communications projects are featured. Course provides comparisons of project development and delivery approaches for mega-projects around the world. Alternative project delivery methods, the role of public and private sector, different project management strategies, and lessons learned. Field trips to local projects.
CEE 246B	Real Estate Finance Seminar	1	Real estate principles and process. Financial modeling. Feasibility analysis. Sources and uses of funds. Cash flow projections. Profit and loss reports. Financing issues for different types of real estate projects. Redevelopment projects. Financing green projects and technologies. Current challenges in financial markets. Group project and presentation.
CEE 256	Building Systems	4	HVAC, lighting, and envelope systems for commercial and institutional buildings, with a focus on energy efficient design. Knowledge and skills required in the development of low-energy buildings that provide high quality environment for occupants.
CEE 258	Donald R. Watson Seminar in Construction Engineering and Management	1	Presentations from construction industry leaders. Discussions with speakers from various segments of industry regarding career options. Student groups interact with industry representatives after class.
CEE 262B	Transport and Mixing in Surface Water Flows	3-4	Application of fluid mechanics to problems of pollutant transport and mixing in the water environment. Mathematical models of advection, diffusion, and dispersion. Application of theory to problems of transport and mixing in rivers, estuaries, and lakes and reservoirs.
CEE 263B	Numerical Weather Prediction	3-4	Numerical weather prediction. Continuity equations for air and water vapor, the thermodynamic energy equation, and momentum equations derived for the atmosphere. Numerical methods of solving partial differential equations, including finite-difference, finite-element, semi-Lagrangian, and pseudospectral methods. Time-stepping schemes: the forward-Euler, backward-Euler, Crank-Nicolson, Heun, Matsuno, leapfrog, and Adams-Bashforth schemes. Boundary-layer turbulence parameterizations, soil moisture, and cloud modeling. Project developing a basic weather prediction model.
CEE 263C	Weather and Storms	3	Daily and severe weather and global climate. Topics: structure and composition of the atmosphere, fog and cloud formation, rainfall, local winds, wind energy, global circulation, jet streams, high and low pressure systems, inversions, el Niño, la Niña, atmosphere/ocean interactions, fronts, cyclones, thunderstorms, lightning, tornadoes, hurricanes, pollutant transport, global climate and atmospheric optics.
CEE 263D	Air Pollution and Global Warming: History, Science, and Solutions	3	Survey of Survey of air pollution and global warming and their renewable energy solutions. Topics: evolution of the Earth's atmosphere, history of discovery of chemicals in the air, bases and particles in urban smog, visibility, indoor air pollution, acid rain, stratospheric and Antarctic ozone loss, the historic climate record, causes and effects of global warming, impacts of energy systems on pollution and climate, renewable energy solutions to air pollution and global warming.

CEE 264A	Rivers, Streams, and Canals	3-4	Introduction to the movement of water through natural and engineered channels, streams, and rivers. Basic equations and theory (mass, momentum, and energy equations) for steady and unsteady descriptions of the flow. Application of theory to the design of flood- control and canal systems. Flow controls such as weirs and sluice gates; gradually varied flow; Saint-Venant equations and flood waves; and method of characteristics. Open channel flow laboratory experiments: controls such as weirs and gates, gradually varied flow, and waves.
CEE 265A	Sustainable Water Resources Development	3	Alternative criteria for judging the sustainability of projects. Application of criteria to evaluate sustainability of water resources projects in several countries. Case studies illustrate the role of political, social, economic, and environmental factors in decision making. Influence of international aid agencies and NGOs on water projects. Evaluation of benefit-cost analysis and environmental impact assessment as techniques for enhancing the sustainability of future projects.
CEE 265C	Water Resources Management	3	Examination of the basic principles of surface and ground water resources management in the context of increasing water scarcity and uncertainty due to climate change and other factors. Specific topics include reservoir, river basin and aquifer management, conjunctive use of surface andn ground water, and treated wastewater reuse. Special emphasis is placed on demand management through conservation, increased water use efficiency and economic measures. Besides the technical aspects of water management, an overview of its legal and institutional framework is provided.
CEE 266A	Watersheds and Wetlands	3	Introduction to the occurrence and movement of water in the natural environment and its role in creating and maintaining terrestrial, wetland, and aquatic habitat. Hydrologic processes, including precipitation, evaporation, transpiration, snowmelt, infiltration, subsurface flow, runoff, and streamflow. Rivers and lakes, springs and swamps. Emphasis is on observation and measurement, data analysis, modeling, and prediction.
CEE 266B	Floods and Droughts, Dams and Aqueducts	3	Sociotechnical systems associated with human use of water as a resource and the hazards posed by too much or too little water. Potable and non-potable water use and conservation. Irrigation, hydroelectric power generation, rural and urban water supply systems, storm water management, flood damage mitigation, and water law and institutions. Emphasis is on engineering design.
CEE 266C	Advanced Topics in Hydrology and Water Resources	3	Graduate seminar. Focus is on one or more hydrologic processes or water resources systems. Topics vary based on student and instructor interest. Examples include freshwater wetland hydrology, watershed-scale hydrologic modeling, renaturalization of stream channels, reservoir sediment management, and dam removal.
CEE 266D	Water Resources and Water Hazards Field Trips	2	Introduction to water use and water hazards via weekly field trips to local and regional water resources facilities (dams, reservoirs, fish ladders and hatcheries, pumping plants, aqueducts, hydropower plants, and irrigation systems) and flood damage mitigation facilities (storm water detention ponds, channel modifications, flood control dams, and reservoirs). Each trip preceded by an orientation lecture.
CEE 269A	Environmental Fluid Mechanics and Hydrology Seminar	1	Problems in all branches of water resources. Talks by visitors, faculty, and students.

CEE 269C	Environmental Fluid Mechanics and Hydrology Seminar	1	Problems in all branches of water resources. Talks by visitors, faculty, and students.
CEE 270	Movement and Fate of Organic Contaminants in Waters	3	Transport of chemical constituents in surface and groundwater including advection, dispersion, sorption, interphase mass transfer, and transformation; impacts on water quality. Emphasis is on physicochemical processes and the behavior of hazardous waste contaminants.
CEE 271B	Environmental Biotechnology	4	Stoichiometry, kinetics, and thermodynamics of microbial processes for the transformation of environmental contaminants. Design of dispersed growth and biofilm-based processes. Applications include treatment of municipal and industrial waste waters, detoxification of hazardous chemicals, and groundwater remediation.
CEE 271D	Introduction to Wastewater Treatment Process Modeling	2	The course will present a structured protocol for simulator application comprising project definition, data collection and reconciliation, model set-up, calibration and validation, and simulation and result interpretation. This course will include a series of guided simulation exercises evaluating resource consumption (e.g., electrical energy, natural gas, chemicals) and resource recovery (e.g., biogas, struvite, biosolids, recycled water) from a variety of treatment plant configurations. Coursework for all students will comprise guided simulation exercises begun in class. Students may elect to take the course for 2 units by completing a group project evaluating an assigned plant configuration and presenting the results before the class.
CEE 272	Coastal Contaminants	3-4	Coastal pollution and its effects on ecosystems and human health. The sources, fate, and transport of human pathogens and nutrients. Background on coastal ecosystems and coastal transport phenomena including tides, waves, and cross shelf transport. Introduction to time series analysis with MATLAB.
CEE 272R	Modern Power Systems Engineering	3	Focus is on Power Engineering from a systems point of view. Topics covered may include modeling of generation, transmission and distribution systems, load flow analysis, transient and steady-state stability analysis. Special emphasis given to modern market operations and dispatch, modeling intermittent controllable power sources, storage technologies, mechanisms for demand response, sensing the grid and the role of market mechanisms for deep integration. Course content may vary year to year.
CEE 272S	Greenhouse Gas Mitigation	1-3	This course will introduce the main concepts of greenhouse gas (GHG) emissions measurement and management, and it will explore the main mitigation options for reducing emissions or sequestering carbon dioxide. It will address technical aspects of GHG mitigation via energy efficiency and demand-side management, energy in high-technology industry, distributed power and co-generation, the role of renewable energy in GHG management, carbon sequestration in forestry, agriculture, and geological formations. The course explores policy options, carbon trading and business strategies for GHG mitigation.
CEE 273	Aquatic Chemistry	3	Chemical principles and their application to the analysis and solution of problems in aqueous geochemistry (temperatures near 25° C and atmospheric pressure). Emphasis is on natural water systems and the solution of specific chemical problems in water purification technology and water pollution control.

CEE 273A	Water Chemistry Laboratory	3	Laboratory application of techniques for the analysis of natural and contaminated waters, emphasizing instrumental techniques.
CEE 274A	Environmental Microbiology	3	Basics of microbiology and biochemistry. The biochemical and biophysical principles of biochemical reactions, energetics, and mechanisms of energy conservation. Diversity of microbial catabolism, flow of organic matter in nature: the carbon cycle, and biogeochemical cycles. Bacterial physiology, phylogeny, and the ecology of microbes in soil and marine sediments, bacterial adhesion, and biofilm formation. Microbes in the degradation of pollutants.
CEE 274B	Microbial Bioenergy Systems	3	Introduction to microbial metabolic pathways and to the pathway logic with a special focus on microbial bioenergy systems. The first part of the course emphasizes the metabolic and biochemical principles of pathways, whereas the second part is more specifically directed toward using this knowledge to understand existing systems and to design innovative microbial bioenergy systems for biofuel, biorefinery, and environmental applications. There also is an emphasis on the implications of rerouting of energy and reducing equivalents for the fitness and ecology of the organism.
CEE 275C	Water, Sanitation, and Health	3-4	This course addresses sustainability because it explores the intersection between water, sanitation, and health.
CEE 276	Introduction to Human Exposure Analysis	3	Scientific and engineering issues involved in quantifying human exposure to toxic chemicals in the environment. Pollutant behavior, inhalation exposure, dermal exposure, and assessment tools. Overview of the complexities, uncertainties, and physical, chemical, and biological issues relevant to risk assessment. Lab projects.
CEE 277S	Design for a Sustainable World	1-5	Technology-based problems faced by developing communities worldwide. Student groups partner with organizations abroad to work on concept, feasibility, design, implementation, and evaluation phases of various projects. Past projects include a water and health initiative, a green school design, seismic safety, and medical device. Admission based on written application and interview.
CEE 277X	Current Topics in Sustainable Engineering	1-5	This course is the first half of a two quarter, project-based design course that addresses the cultural, political, organizational, technical, and business issues at the heart of implementing sustainable engineering projects in the developing world. Students will be placed into one of three project teams and tackle a real-world design challenge in partnership with social entrepreneurs and NGOs. In CEE 177X/277X, students will gain the background skills and context necessary to effectively design engineering projects in developing nations.
CEE 278A	Air Pollution Fundamentals	3-4	The sources and health effects of gaseous and particulate air pollutants. The influence of meteorology on pollution: temperature profiles, stability classes, inversion layers, turbulence. Atmospheric diffusion equations, downwind dispersion of emissions from point and line sources. Removal of air pollutants via settling, diffusion, coagulation, precipitation, Mechanisms for ozone formation, in the troposphere versus in the stratosphere. Effects of airborne particle size and composition on light scattering/absorption, and on visual range.

CEE 279	Environmental Engineering Seminar	1	Current research, practice, and thinking in environmental engineering and science. Attendance at seminars is self-directed, the 20 hours of required seminar attendance may be accrued throughout the school year. Must prepare a publication synopsis, and maintain log of seminar attendance.
CEE 279H	Urban Hydrology	1	Weekly seminar and roundtable on current topics involving hydrology in the urban environment.
CEE 279S	Issues in Environmental Science, Technology, and Sustainability	1-2	Invited faculty, researchers and professionals share their insights and perspectives on a broad range of environmental and sustainability issues. Students critique seminar presentations and associated readings.
CEE 287	Earthquake Resistant Design and Construction	3-4	Evaluation, design, and construction of structures in seismic regions. Factors influencing earthquake ground motions, design spectra, design of linear and nonlinear single- and multiple-degree-of-freedom-system structures, force-based and displacement-based design methods, capacity design, detailing and construction of steel and reinforced concrete structures, introduction to performance-based design, seismic isolation, and energy dissipation.
CEE 289	Random Vibrations	3-4	Introduction to random processes. Correlation and power spectral density functions. Stochastic dynamic analysis of multi-degree-of-freedom structures subjected to stationary and non-stationary random excitations. Crossing rates, first-excursion probability, and distributions of peaks and extremes. Applications in earthquake, wind, and ocean engineering.
CEE 297M	Managing Critical Infrastructure Seminar	1-2	Safe and effective performance of infrastructure systems is critical to our economy, quality of life and safety. This course will present topics associated with risk analysis and management of critical civil infrastructure systems, acceptable risk and community resilience. Discuss lessons from Hurricane Katrina, Tohoku earthquake, among others which dictate the need for changes to how infrastructure systems are analyzed, designed and operated. Methods of risk analysis for spatially distributed infrastructure systems; seismic and flood risk analysis. Guest speakers. Student presentations.
CEE 363G	Field Techniques in Coastal Oceanography	3	This course focuses on the design and implementation of coastal oceanographic field studies from implementation through analysis. A wide range of field instrumentation and techniques, including AUVs and scientific diving is covered. Field studies. Data collection and analysis under instructor guidance.
CEE 371	Frontiers in Environmental Research	1-2	How to evaluate environmental research.
CEE 70	Environmental Science and Technology	3	Introduction to environmental quality and the technical background necessary for understanding environmental issues, controlling environmental degradation, and preserving air and water quality. Material balance concepts for tracking substances in the environmental and engineering systems.

CHEM 10	Exploring Research and Problem Solving Across the Sciences	2	Development and practice of critical problem solving and study skills using wide variety of scientific examples that illustrate the broad yet integrated nature of current research. Student teams will have the opportunity to explore and present on topics revolving around five central issues: energy, climate change, water resources, medicine, and food & nutrition from a chemical perspective.
CHEM 111	Exploring Chemical Research at Stanford	1	Preference to freshmen and sophomores. Department faculty describe their cutting-edge research and its applications.
CHEM 135	Physical Chemical Principles	3	Introductory physical chemistry intended for students of the life sciences, geology and environmental engineering. Chemical kinetics: rate laws, integration of rate laws, reaction mechanisms, enzyme kinetics. Chemical thermodynamics: first, second and third laws, thermochemistry, entropy, free energy, chemical equilibrium, physical equilibrium, osmotic pressure, other colligative properties.
CHEM 25N	Science in the News	3	Preference to freshmen. Possible topics include: diseases such as avian flu, HIV, and malaria; environmental issues such as climate change, atmospheric pollution, and human population; energy sources in the future; evolution; stem cell research; nanotechnology; and drug development. Focus is on the scientific basis for these topics as a basis for intelligent discussion of societal and political implications. Sources include the popular media and scientific media for the nonspecialist, especially those available on the web.
CHEMENG 10	The Chemical Engineering Profession	1	Open to all undergraduates. Overview of and careers in chemical engineering; opportunities to develop networks with working professionals. Panel discussions on career paths and post-graduation opportunities available. Areas include biotechnology, electronics, energy, environment, management consulting, nanotechnology, and graduate school in business, law, medicine, and engineering.
CHEMENG 120B	Energy and Mass Transport	4	General diffusive transport, heat transport by conduction, Fourier's law, conduction in composites with analogies to electrical circuits, advection-diffusion equations, forced convection, boundary layer heat transport via forced convection in laminar flow, forced convection correlations, free convection, free convection boundary layers, free convection correlations and application to geophysical flows, melting and heat transfer at interfaces, radiation, diffusive transport of mass for dilute and non-dilute transfer, mass and heat transport analogies, mass transport with bulk chemical reaction, mass transport with interfacial chemical reaction, evaporation.
CHEMENG 180	Chemical Engineering Plant Design	3	Open to seniors in chemical engineering or by consent of instructor. Application of chemical engineering principles to the design of practical plants for the manufacture of chemicals and related materials. Topics: flow-sheet development from a conceptual design, equipment design for distillation, chemical reactions, heat transfer, pumping, and compression; estimation of capital expenditures and production costs; plant construction.

CHEMENG 20	Introduction to Chemical Engineering	3	Overview of chemical engineering through discussion and engineering analysis of physical and chemical processes. Topics: overall staged separations, material and energy balances, concepts of rate processes, energy and mass transport, and kinetics of chemical reactions. Applications of these concepts to areas of current technological importance: biotechnology, energy, production of chemicals, materials processing, and purification.
CHEMENG 240	Micro and Nanoscale Fabrication Engineering	3	Survey of fabrication and processing technologies in industrial sectors, such as semiconductor, biotechnology, and energy. Chemistry and transport of electronic and energy device fabrication. Solid state materials, electronic devices and chemical processes including crystal growth, chemical vapor deposition, etching, oxidation, doping, diffusion, thin film deposition, plasma processing. Micro and nanopatterning involving photolithography, unconventional soft lithography and self assembly.
CHEMENG 242	Basic Principles of Heterogeneous Catalysis with Applications in Energy Transformations	3	Introduction to heterogeneous catalysis, including models of surface reactivity, surface equilibria, kinetics of surface reactions, electronic and geometrical effects in heterogeneous catalysis, trends in reactivity, catalyst structure and composition, electro-catalysis and photo-catalysis. Selected applications and challenges in energy transformations will be discussed.
CHEMENG 25E	Energy: Chemical Transformations for Production, Storage and Use	3	An introduction and overview to the challenges and opportunities of energy supply and consumption. Emphasis on energy technologies where chemistry and engineering play key roles. Review of energy fundamentals along with historical energy perspectives and current energy production technologies. In depth analysises of solar thermal systems, biofuels, photovoltaics and electrochemical devices (batteries and fuel cells).
CHEMENG 262	Fundamentals of Polymers for Energy and Environmental Sustainability	3	The first five weeks of this course will be devoted to the fundamental aspects of polymers necessary to understand the applications in energy and the environment. These include: polymer chain configuration, morphology of semi-crystalline and amorphous solids, thermal transition behavior, thermodynamics of polymer blends and block copolymers, and the time/temperature dependence of linear viscoelasticity. The remaining five weeks of class will be devoted to applications, with special emphasis on membrane transport, including ion transport in fuel cell exchange membranes, gas transport in hydrogen enrichment membranes, and water transport in desalination membranes. In addition, completely degradable biocomposites will be discussed.
CHEMENG 296	Entrepreneurship in Engineering and Science-based Industries	3	Open to seniors and graduate students interested in entrepreneurship in engineering and science intensive industries such as chemical, energy, materials, bioengineering, environmental, clean-tech, pharmaceuticals, medical, and biotechnology. Exploration of the dynamics, complexity, and challenges that define entrepreneurship, particularly for companies that require long development times, large investments, integration across a wide range of technical and non-technical disciplines, and the creation and protection of intellectual property. Covers business basics, opportunity viability, creating start-ups, entrepreneurial leadership, and entrepreneurship as a career. Teaching methods include lectures, case studies, guest speakers, and individual and team projects.

CHEMENG 35N	Renewable Energy for a Sustainble World	3	Preference to freshmen. Organized to prepare a renewable energy plan for California. Energy concepts and quantitation approaches are learned, energy needs and natural resources are assessed, and renewable energy technologies are evaluated for economic performance and environmental impact. An investment plan is developed along with implementation and research recommendations. The same concepts are then applied to Mexico as a second model system.
CHEMENG 432	Electrochemical Energy Conversion	3	Electrochemistry is playing an increasingly important role in renewable energy. This course aims to cover the fundamentals of electrochemistry, and then build on that knowledge to cover applications of electrochemistry in energy conversion. Topics to be covered include fuel cells, solar water-splitting, CO2 conversion to fuels and chemicals, batteries, redox flow cells, and supercapacitors.
CHEMENG 60Q	Environmental Regulation and Policy	3	Preference to sophomores. How environmental policy is formulated in the U.S. How and what type of scientific research is incorporated into decisions. How to determine acceptable risk, the public's right to know of chemical hazards, waste disposal and clean manufacturing, brownfield redevelopment, and new source review regulations. The proper use of science and engineering including media presentation and misrepresentation, public scientific and technical literacy, and emotional reactions. Alternative models to formulation of environmental policy. Political and economic forces, and stakeholder discussions.
CHEMENG 699	Colloquium	1	Weekly lectures by experts from academia and industry in the field of chemical engineering.
CHEMENG 70Q	Masters of Disaster	3	Preference to sophomores. For students interested in science, engineering, politics, and the law. Learn from past disasters to avoid future ones. How disasters can be tracked to failures in the design process. The roles of engineers, artisans, politicians, lawyers, and scientists in the design of products. Failure as rooted in oversight in adhering to the design process. Student teams analyze real disasters and design new products presumably free from the potential for disastrous outcomes.
CHILATST 125S	Chicano/Latino Politics	5	The political position of Latinos and Latinas in the U.S.. Focus is on Mexican Americans, with attention to Cuban Americans, Puerto Ricans, and other groups. The history of each group in the American polity; their political circumstances with respect to the electoral process, the policy process, and government; the extent to which the demographic category Latino is meaningful; and group identity and solidarity among Americans of Latin American ancestry. Topics include immigration, education, affirmative action, language policy, and environmental justice.
CHINAGEN 241	Emergence of Chinese Civilization from Caves to Palaces	3-4	Introduces processes of cultural evolution from the Paleolithic to the Three Dynasties in China. By examining archaeological remains, ancient inscriptions, and traditional texts, four major topics will be discussed: origins of modern humans, beginnings of agriculture, development of social stratification, and emergence of states and urbanism.

CLASSGEN 223	Urban Sustainability: Long-Term Archaeological Perspectives	3-5	Comparative and archaeological view of urban design and sustainability. How fast changing cities challenge human relationships with nature. Innovation and change, growth, industrial development, the consumption of goods and materials. Five millennia of city life including Near Eastern city states, Graeco-Roman antiquity, the Indus Valley, and the Americas.
COMM 165N	Cars: Past, Present, and Future	3	Focus on the past, present and future of the automobile, bridging the Humanities, Social Sciences, Design, and Engineering. Focus on the human experiences of designing, making, driving, being driven, living with, and dreaming of the automobile. A different theme will be featured each week in discussion around a talk and supported by key readings and media. The course is informed by history, archaeology, ethnography, human-technology interaction, mechanical engineering, and cognitive science. Preference to freshmen.
COMPLIT 368	Imagining the Oceans	5	How has Western culture constructed the world's oceans since the beginning of global ocean exploration? How have imaginative visions of the ocean been shaped by marine science, technology, exploration, commerce and leisure? Readings might include voyage accounts by Cook and Darwin, sailors' narratives by Equiano and Dana, poetry by Coleridge, Bishop and Walcott, novels by Melville, Verne, Conrad and Woolf. Visual culture might include paintings by Turner and Redon, and films by Jean Painlevé, Kathryn Bigelow, Jerry Bruckheimer and James Cameron. Critical texts will be drawn from interdisciplinary theorists of modernity and mobility, such as Schmitt, Wallerstein, Corbin, Latour, Deleuze + Guattari, and Cresswell.
COMPMED 80Q	Introduction to Animal Behavior	3	Preference to freshmen. Behavior is what makes animals special (thirsty plants don't walk to water), but why do animals behave the way they do? What does their behavior tell us about their inner lives, and about ourselves? What do lipstick and cuckoos and fireflies have in common? Why would nobody want to be a penguin? What do mice say to each other in their pee-mail? Learning how to think about questions like these gives us a unique perspective on the natural world. Format: Discussion and criticism of video examples, documentaries, and research papers. Topics: History and approaches to animal behavior; development of behavior, from genetics to learning; mechanisms of behavior, from neurons to motivation; function of behavior, from honest signals to selfish genes; the phylogeny of behavior, from domestication to speciation; and modern applications of behavior, from abnormal behavior, to conservation, to animal welfare, and animal consciousness.
COMPMED 81N	Comparative Anatomy and Physiology of Mammals	3	Preference to freshmen. Emphasis is on a comparative approach to anatomy and physiology of a wide range of mammals, the unique adaptations of each species in terms of its anatomical, and behavioral characteristics, and how these species interact with human beings and other animals. Dissection required.
CS 546	Seminar on Liberation Technologies	1	This one-unit seminar will present speakers relevant in a variety ofnnways to how various forms of information technology are being used to defend human rights, improve governance, deepen democracy, empower thennpoor, promote economic development, protect the environment, enhance public health, and pursue a variety of other social goods.

CSRE 146	Community Matters: Research and Service with Community Organizations	2	Methods and principles for academic research in community settings for students preparing to enter summer experiences with community organizations. Case studies and tools to help students conceptualize a research strateg. Students develop a memorandum of understanding in collaboration with the community agency to define the work, relationship, and mutual benefit of the research partnership.
CSRE 99A	Art in Our Time: Ethics and Aesthetics of Crisis	4	This course explores the ethical and aesthetic questions artists engage when facing, in their own time and place, social crises such as arise from the physical and psychic effects of war or political instability arising from disasters manmade and natural, the drug war in Mexico, the earthquakes in Haiti and Japan, the Arab Spring, the Great Recession. Readings will include both critical and creative texts that look at historical and contemporary examples of artists representing such experiences. In addition, students will be called upon to create their own artistic productions writing, music, theatrical or multimedia (including online) in a workshop setting. By definition, the course considers the current historical moment to be one of crisis, in which students across the world are alternately, or simultaneously, its victims and engaged witnesses.
EARTHSCI 1	Current Research in the Earth and Environmental Sciences	1	Primarily for freshmen and sophomores. An introduction to faculty and research areas in the School of Earth Sciences, including biogeochemistry, oceanography, paleobiology, geophysics, tectonics, geostatistics, soil science, hydrogeology, energy resources, earth surface processes, geochronology, volcanoes and earthquakes, and remote sensing.
EARTHSCI 100	Research Preparation for Undergraduates	1	For undergraduates planning to conduct research during the summer with faculty in the School of Earth Sciences. Readings, oral presentations, proposal development.
EARTHSCI 117	Earth Sciences of the Hawaiian Islands	4	Progression from volcanic processes through rock weathering and soil-ecosystem development to landscape evolution. The course starts with an investigation of volcanic processes, including the volcano structure, origin of magmas, physical-chemical factors of eruptions. Factors controlling rock weathering and soil development, including depth and nutrient levels impacting plant ecosystems, are explored next. Geomorphic processes of landscape evolution including erosion rates, tectonic/volcanic activity, and hillslope stability conclude the course. Methods for monitoring and predicting eruptions, defining spatial changes in landform, landform stability, soil production rates, and measuring biogeochemical processes are covered throughout the course. This course is restricted to students accepted into the Earth Systems of Hawaii Program.
EARTHSCI 180	Introduction to Earth and Environmental Science Research Design	1	This course is an introduction to research planning and proposal writing. The primary focus of the course is on practical skill development: identifying relevant scientific literature, reading scientific articles, project planning, and proposal writing. In addition, you will hear from faculty and staff around the university about research methods and the scientific process. The course is designed around writing your own project proposal, with additional skill development exercises. Students are expected to come to this class with a research idea and a research advisor outside of this course. Preference to undergraduates writing applications for summer or honors research grants (e.g., SES, VPUE). Open to other projects and students with instructor permission.

EARTHSCI 251	Negotiation	3	Students learn to prepare for and conduct negotiations in a variety of arenas including getting a job, managing workplace conflict, negotiating transactions, and managing personal relationships. Interactive class. The internationally travelled instructor who has mediated cases in over 75 countries will require students to negotiate real life case studies and discuss their results in class.
EARTHSCI 300	Earth Sciences Seminar	1	Required for incoming graduate students except coterms. Research questions, tools, and approaches of faculty members from all departments in the School of Earth Sciences. Goals are: to inform new graduate students about the school's range of scientific interests and expertise; and introduce them to each other across departments and research groups. Panel discussions or faculty member presentations at each meeting.
EARTHSYS 100	Environmental and Geological Field Studies in the Rocky Mountains	3	Three-week, field-based program in the Greater Yellowstone/Teton and Wind River Mountains of Wyoming. Field-based exercises covering topics including: basics of structural geology and petrology; glacial geology; western cordillera geology; paleoclimatology; chemical weathering; aqueous geochemistry; and environmental issues such as acid mine drainage and changing land-use patterns.
EARTHSYS 102	Renewable Energy Sources and Greener Energy Processes	3	Demographic methods and their application to understanding and projecting changes in human infant, child, and adult mortality and health, fertility, population, sex ratios, and demographic transitions. Progress in human development, capabilities, and freedoms. Relationships between population and environment.
EARTHSYS 105	Food and Community: New Visions for a Sustainable Future	3-5	Service and research focused on providing healthy and environmentally friendly food for the under served in our community. Hands-on collaboration with the Stanford Glean student group, the Stanford Community Garden, and San Francisco nonprofits. Coverage of the broad spectrum from garden development to food dispersal to the needy. Design and implementation of projects that address an aspect of food and social justice, such as urban farming in low-income communities and sustainable food networks for the elderly. Service Learning Course (certified by Haas Center).
EARTHSYS 105A	Ecology and Natural History of Jasper Ridge Biological Preserve	4	Jasper Ridge Docent Training. First of two-quarter sequence training program to join the Jasper Ridge education/docent program. The scientific basis of ecological research in the context of a field station, hands-on field research, field ecology and the natural history of plants and animals, species interactions, archaeology, geology, hydrology, land management, multidisciplinary environmental education; and research projects, as well as management challenges of the preserve presented by faculty, local experts, and staff. Participants lead research-focused educational tours, assist with classes and research, and attend continuing education classes available to members of the JRBP community after the course.
EARTHSYS 112	Human Society and Environmental Change	4	Interdisciplinary approaches to understanding human-environment interactions with a focus on economics, policy, culture, history, and the role of the state.

EARTHSYS 116	Ecology of the Hawaiian Islands	4	Terrestrial and marine ecology and conservation biology of the Hawaiian Archipelago. Taught in the field in Hawaii as part of quarter-long sequence of courses including Earth Sciences and Anthropology. Topics include ecological succession, plant-soil interactions, conservation biology, biological invasions and ecosystem consequences, and coral reef ecology. Restricted to students accepted into the Earth Systems of Hawaii Program.
EARTHSYS 122	Paleobiology	4	Introduction to the fossil record with emphasis on marine invertebrates. Major debates in paleontological research. The history of animal life in the oceans. Topics include the nature of the fossil record, evolutionary radiations, mass extinctions, and the relationship between biological evolution and environmental change. Fossil taxa through time. Exercises in phylogenetics, paleoecology, biostratigraphy, and statistical methods.
EARTHSYS 12SC	Environmental and Geological Field Studies in the Rocky Mountains	2	The ecologically and geologically diverse Rocky Mountain area is being strongly impacted by changing land use patterns, global and regional environmental change, and societal demands for energy and natural resources. This field program emphasizes coupled environmental and geological problems in the Rocky Mountains, covering a broad range of topics including the geologic origin of the American West from three billion years ago to the present; paleoclimatology and the glacial history of this mountainous region; the long- and short-term carbon cycle and global climate change; and environmental issues in the American West related to changing land-use patterns and increased demand for its abundant natural resources. These broad topics are integrated into a coherent field-study as we examine earth/ environmental science-related questions in three different settings: 1) the three-billion-year-old rocks and the modern glaciers of the Wind River Mountains of Wyoming; 2) the sediments in the adjacent Wind River basin that host abundant gas and oil reserves and also contain the long-term climate history of this region; and 3) the volcanic center of Yellowstone National Park and the mountainous region of Teton National Park, and the economic and environmental problems associated with gold mining and extraction of oil and gas in areas adjoining these national parks. Students will complete six assignments based upon field exercises, working in small groups to analyze data and prepare reports and maps. Lectures will be held in the field prior to and after fieldwork. Note: This course involves one week of backpacking in the Wind Rivers and hiking while staying in cabins near Jackson Hole, Wyoming.
EARTHSYS 18	Promoting Sustainability Behavior Change at Stanford	2	Stanford Green Living Council training course. Effective strategies for enacting sustainable behavior change on campus. Community-based social marketing, psychology, sociology, and design. Behavior change intervention project targeting a specific sustainable behavior. Lectures online.
EARTHSYS 200	Sustaining Action: Research, Analysis, and Writing for the Public	3	Preference to graduate students and senior undergraduates in environmental, natural and social sciences, engineering, journalism. Students help produce and publish SAGE, an eco advice column, by choosing, researching, and answering questions about sustainable living submitted by Stanford alumni and the general public.

EARTHSYS 210A	Senior Seminar	3	Interdisciplinary problem analysis and oral communication. Students present results of their Earth Systems internship or research project. Students participate in a research or service learning group project focused on a local environmental issue. Service Learning Course (certified by Haas Center).
EARTHSYS 226	Institutions and the Natural Environment	4	Institutional theory is one of the most dynamic fields in social science today. The course will explore foundational and more recent literature in institutional theory from different disciplinary perspectives as it applies to environmental issues. Critical reading and active discussions will contribute to a deeper understanding of how environmental change is informed by institutions and organizations.
EARTHSYS 241	Remote Sensing of the Oceans	3-4	How to observe and interpret physical and biological changes in the oceans using satellite technologies. Topics: principles of satellite remote sensing, classes of satellite remote sensors, converting radiometric data into biological and physical quantities, sensor calibration and validation, interpreting large-scale oceanographic features.
EARTHSYS 246A	Atmosphere, Ocean, and Climate Dynamics: The Atmospheric Circulation	3	Introduction to the physics governing the circulation of the atmosphere and ocean and their control on climate with emphasis on the atmospheric circulation. Topics include the global energy balance, the greenhouse effect, the vertical and meridional structure of the atmosphere, dry and moist convection, the equations of motion for the atmosphere and ocean, including the effects of rotation, and the poleward transport of heat by the large-scale atmospheric circulation and storm systems.
EARTHSYS 246B	Atmosphere, Ocean, and Climate Dynamics: The Ocean Circulation	3	Introduction to the physics governing the circulation of the atmosphere and ocean and their control on climate with emphasis on the large-scale ocean circulation. This course will give an overview of the structure and dynamics of the major ocean current systems that contribute to the meridional overturning circulation, the transport of heat, salt, and biogeochemical tracers, and the regulation of climate. Topics include the tropical ocean circulation, the wind-driven gyres and western boundary currents, the thermohaline circulation, the Antarctic Circumpolar Current, water mass formation, atmosphere-ocean coupling, and climate variability.
EARTHSYS 274	Marine Biodiversity: Law, Science, and Policy	3	Examination of the mechanisms that create marine biodiversity and the ways in which biodiversity and natural resources are linked. Introduction to the federal laws and policies that impact marine biodiversity and natural resources. Interactions between biological and political systems.
EARTHSYS 275	California Coast: Science, Policy, and Law	3-4	Interdisciplinary. The legal, science, and policy dimensions of managing California's coastal resources. Coastal land use and marine resource decision making. The physics, chemistry, and biology of the coastal zone, tools for exploring data from the coastal ocean, and the institutional framework that shapes public and private decision making. Field work: how experts from different disciplines work to resolve coastal policy questions. Primarily for graduate students; upper-level undergraduates may enroll with permission of instructor. Students will be expected to participate in at least three mandatory field trips.
EARTHSYS 283	Food Matters: Agriculture in Film	1	Film series presenting historical and contemporary issues dealing with food and agriculture across the globe. Students discuss reactions and thoughts in a round table format.

EARTHSYS 288	Social and Environmental Tradeoffs in Climate Decision-Making	1-2	How can we ensure that measures taken to mitigate global climate change don¿t create larger social and environmental problems? What metrics should be used to compare potential climate solutions beyond cost and technical feasibility, and how should these metrics be weighed against each other? How can modeling efforts and stakeholder engagement be best integrated into climate decision making? What information are we still missing to make fully informed decisions between technologies and policies? Exploration of these questions, alongside other issues related to potential negative externalities of emerging climate solutions. Evaluation of energy, land use, and geoengineering approaches in an integrated context, culminating in a climate stabilization group project.
EARTHSYS 290	Master's Seminar	2	Required of and open only to Earth Systems master's students. Reflection on the Earth Systems coterm experience and development of skills to clearly articulate interdisciplinary expertise to potential employers, graduate or professional schools, colleagues, business partners, etc. Hands-on projects to take students through a series of guided reflection activities. Individual and small group exercises. Required, self-chosen final project encapsulates each student's MS expertise in a form relevant to his or her future goals (ie. a personal statement, research poster, portfolio, etc.).
EARTHSYS 323	Stanford at Sea	16	Five weeks of marine science including oceanography, marine physiology, policy, maritime studies, conservation, and nautical science at Hopkins Marine Station, followed by five weeks at sea aboard a sailing research vessel in the Pacific Ocean. Shore component comprised of three multidisciplinary courses meeting daily and continuing aboard ship. Students develop an independent research project plan while ashore, and carry out the research at sea. In collaboration with the Sea Education Association of Woods Hole, MA.
EARTHSYS 37N	Climate Change: Science and Society	3	Preference to freshmen. How and why do greenhouse gases cause climate to change? How will a changing climate affect humans and natural ecosystems? What can we do to prevent climate change and better adapt to the climate change that does occur? This course will focusing on developing quantitative understanding of these issues rooted in both the physical and social sciences. Exercises will be based on simple quantitative observations and calculations; algebra only, no calculus.
EARTHSYS 42	The Global Warming Paradox II	1	Further discussion of the complex climate challenges posed by the substantial benefits of energy consumption, including the critical tension between the enormous global demand for increased human well-being and the negative climate consequences of large-scale emissions of carbon dioxide. Discussions of topics of student interest, including peer-reviewed scientific papers, current research results, and portrayal of scientific findings by the mass media and social networks. Focus is on student engagement in on-campus and off-campus activities.
EARTHSYS 46N	Exploring the Critical Interface between the Land and Monterey Bay: Elkhorn Slough	3	Preference to freshmen. Field trips to sites in the Elkhorn Slough, a small agriculturally impacted estuary that opens into Monterey Bay, a model ecosystem for understanding the complexity of estuaries, and one of California's last remaining coastal wetlands. Readings include Jane Caffrey's *Changes in a California Estuary: A Profile of Elkhorn Slough* . Basics of biogeochemistry, microbiology, oceanography, ecology, pollution, and environmental management.

EARTHSYS 5	Ecology for Everyone	4	Basics of ecology, from gut bacteria to global climate change. We will link processes at several scales to connect individual behavior, population growth, species interactions and ecosystem function. Combining classroom and field experience, we will see how basic hypothesis testing provides a way to learn about the world by considering the ecology of familiar organisms such as ants, squirrels, trees and some kinds of food. No prerequisites except arithmetic; open to everyone, including but not only those who may be headed for more advanced courses in ecology and environmental science.
EARTHSYS 70	How the Earth Works: Physics for Earth and Environmental Scientists	3	How do tsunamis form? What drives a hurricane? How are environmental pollutants transported? Introduction to the study of motion, forces, waves, and electromagnetism from the perspective of Earth and environmental scientists. Examination of the physics behind Earth processes that shape the environment we live in. Topics include groundwater flow, geothermal gradients, tidal and tsunami wave motion, seismic waves, earthquake propagation and hazard assessment, and the energy of photosynthesis. Lab/computer exercises incorporated into class time.
EASTASN 289K	Changing North Korean Society	3	Topics on Korea vary each year. Topics this year is on the changing North Korean society. North Korea is constantly in the news with a lot of analyses based on guess-work and speculation. Having lived and worked in North Korea for 5 years (2006-10), the course content is mainly based on the instructor's experience and includes social and cultural topics, including humanitarian aid and development cooperation, economics, and politics.
ECON 118	Development Economics	5	The microeconomic problems and policy concerns of developing countries. Topics include: land productivity; risk and insurance; microfinance; health and nutrition; education; gender; politics and corruption. Emphasis is on economic models and econometric evidence.
ECON 136	Market Design	5	Use of economic theory and analysis to design allocation mechanisms and market institutions. Course focuses on three areas: the design of matching algorithms to solve assignment problems, with applications to school choice, entry-level labor markets, and kidney exchanges; the design of auctions to solve general resource allocation problems, with applications to the sale of natural resources, financial assets, and advertising; and the design of platforms and exchanges, with applications to internet markets. Emphasis on connecting economic theory to practical applications. Students must write term paper.
ECON 17N	Energy, the Environment, and the Economy	2	Preference to freshmen. The relationship between environmental quality and production and consumption of energy. Can environmentally-friendly energy production and consumption compete with conventional sources? How to estimate and compare environmental impact costs of nonrenewable sources such as fossil fuels and nuclear power versus renewable sources such as solar and wind power. Implicit subsidies in conventional energy sources and the environmental costs of these subsidies. Regulatory and legal barriers to more environmentally friendly energy sources.
ECON 215	Economic Development	2-5	Microeconomic analysis of markets and institutions in developing countries. Topics: agriculture; insurance, credit and saving; health and nutrition; education; public service delivery. Emphasis is on empirical tests of and evidence for theoretical models.

ECON 21N	Economic Inequality	2	Addresses elementary and yet fundamental issues regarding economic inequality including inequality of what?; inequality among whom?; how is inequality measured?; how has inequality changed int he U.S.?; how does inequality in the U.S. compare with inequality elsewhere?; why is inequality what it is and what accounts for changes and differences in inequality? What is the line between taxes and inequality, parents and inequality, and how does poverty relate to inequality? Classroom participation and presentation play an important part in this class.
ECON 23SI	Introduction to Microfinance	1-2	Introduction to microfinance as an important development effort in the war against poverty. Why and how microfinance operations have grown to provide financial services to poor and low-income people on a sustainable basis. Advice and best practices from successful practitioners and institutions around the world as well as new technology startups targeting the industry. Faculty and student led discussions concerning assigned articles and readings.
ECON 250	Environmental Economics	2-5	Theoretical and empirical analysis of sources of and solutions to environmental problems, with application to local pollution challenges and global environmental issues such as climate change. Topics include: analysis of market failure, choice of environmental policy instruments, integrating environmental and distortionary taxes, environmental policy making under uncertainty, valuing environmental amenities, and measuring /promoting sustainable development.
ECON 251	Natural Resource and Energy Economics	2-5	Management and provision non-renewable and renewable natural resources, with considerable attention to energy provision and use. Topics include: fisheries problems and policy; energy industry market structure, pricing, and performance; and policies to facilitate transitions from non-renewable to renewable energy.
ECON 341	Public Economies and Environmental Economics Seminar	1-10	Issues in measuring and evaluating the economic performance of government tax, expenditure, debt, and regulatory policies; their effects on levels and distribution of income, wealth, and environmental quality; alternative policies and methods of evaluation. Workshop format combines student research, faculty presentations, and guest speakers.

EDUC 224A	Social Entrepreneurship and Social Innovation	4	This course examines individuals and organizations that use entrepreneurial skills and approaches to develop innovative responses to social problems. Entrepreneurship has traditionally been seen as a way of creating wealth for the entrepreneur and for those who back her/his work. Social entrepreneurs employ "entrepreneurial skills", such as finding opportunities, inventing new approaches, securing and focusing resources and managing risk, in the service of creating a social value. As the intensity and complexity of social and environmental problems has grown in recent years social entrepreneurship, defined as innovative, social value creating activity that can occur within or across the nonprofit, government, or business sectors, has become increasingly prominent. While virtually all enterprises, commercial and social, generate social value, fundamental to this definition is that the primary focus of social entrepreneurship is to achieve social impact above all else. We will study some of the most promising and the best-proven innovations for improving people's lives. We will also examine mature projects that are now tackling the issue of "scale", moving from local innovations to solutions that create deep systemic changes for larger numbers of economically disadvantaged individuals and communities throughout the world. This year we will focus on what are the constraints and opportunities for creating a social enterprise at scale. The process of "scale" poses tremendous challenges. Even when organizations manage to overcome the many obstacles to growth, and achieve appreciable scale, this approach is seldom sufficient to achieve significant social impact on its own. This year our course will pay particular attention to network approaches which require the mobilization of a vast array of actors and resources, but have the potential to generate rapid and sustained social impact.
EDUC 267G	Integrating the Garden into the Elementary Curriculum	1	This mini-course uses the garden and kitchen environments to provide teacher candidates with real-world contexts in which to explore some of the key issues that children face in health, nutrition, and sustainability. Teacher candidates will gain an understanding of how to integrate the various themes with content areas and standards and an appreciation for the importance of addressing children's health needs in an era when the country is facing increased obesity and other health problems.
EDUC 377B	Strategic Management of Nonprofits	4	Strategic, governance, and management issues facing nonprofit organizations and their leaders in the era of venture philanthropy and social entrepreneurship. Development and fundraising, investment management, performance management, and nonprofit finance. Case studies include smaller, social entrepreneurial and larger, more traditional organizations, including education, social service, environment, health care, religion, NGOs, and performing arts.

EE 152	Green Electronics	4	Many green technologies including hybrid cars, photovoltaic energy systems, efficient power supplies, and energy-conserving control systems have at their heart intelligent, high-power electronics. This course examines this technology and uses green-tech examples to teach the engineering principles of modeling, optimization, analysis, simulation, and design. Topics include power converter topologies, periodic steady-state analysis, control, motors and drives, photovoltaic systems, and design of magnetic components. The course involves a hands-on laboratory and a substantial final project.
EE 216	Principles and Models of Semiconductor Devices	3	Carrier generation, transport, recombination, and storage in semiconductors. Physical principles of operation of the p-n junction, heterojunction, metal semiconductor contact, bipolar junction transistor, MOS capacitor, MOS and junction field-effect transistors, and related optoelectronic devices such as CCDs, solar cells, LEDs, and detectors. First-order device models that reflect physical principles and are useful for integrated-circuit analysis and design.
EE 243	Semiconductor Optoelectronic Devices	3	Semiconductor physics and optical processes in semiconductors. Operating principles and practical device features of semiconductor optoelectronic materials and heterostructures. Devices include: optical detectors (p-i-n, avalanche, and MSM); light emitting diodes; electroabsorptive modulators (Franz-Keldysh and QCSE), electrorefractive (directional couplers, Mach-Zehnder), switches (SEEDs); and lasers (waveguide and vertical cavity surface emitting).
EE 292H	Engineering and Climate Change	1	The purpose of this seminar course is to help equip students and professionals with the tools to apply the engineering mindset to some of the problems that stem from climate change, in order to consider and evaluate possible interventional, remedial and adaptive approaches. This course focuses on some of the climate problems and engineering challenges that seem most critical in addressing climate change. Come join us for fascinating lectures and share ideas as to what engineering approaches maybe of most promise in this area. Very short weekly assignments (half page) to prepare for discussions with the lecturers; suggestions for further readings; and short optional student presentations on topics of interest will round out the class.
EE 292L	Nanomanufacturing	3	Fundamentals of nanomanufacturing technology and applications. Topics include recent developments in process technology, lithography and patterning. Technology for FinFET transistors, NAND flash and 3D chips. Manufacturing of LEDs, thin film and crystalline solar cells. Flip classroom model is used supplementing classroom lectures with short videos. Guest speakers include distinguished engineers, entrepreneurs and venture capitalists actively engaged in nanomanufacturing. Prerequisite: background in device physics and process technology.
EE 392N	Intelligent Energy Systems	1	The key systems engineering steps for design of automated systems in application to of existing and future intelligent energy systems. Existing design approaches and practices for the energy systems. Every second lecture of the course will be a guest lecture discussing the communication system design for a certain type of energy system. They will alternate with guest lectures discuss-ing the on-line analytical functions.

EE 402A	Topics in International Technology Management	1	Theme for Autumn 2012 is "Green Technologies in Transportation: Recent Developments from Asia." Technology and business trends, innovations, and opportunities in Asia and Japan, e.g. new materials, fuels, and energy storage for vehicles; automobile and aircraft design; smart grids and intelligent transportation systems; mobile mesh networks, etc.. Implications for US firms and researchers. Distinguished speakers from industry and government
EE 46	Engineering for Good: Save the World and Have Fun Doing It	3	Projects that provide immediate and positive impact on the world. Focus is on global health by learning from experts in this field. Students work on real-world projects with help from members of NGOs and social entrepreneurial companies as part of the hands-on learning experience.
EE 92A	Making and Breaking Things	1	This course will feature weekly visiting speakers who will guide class members through the hands-on process of assembling or dissection novel interactive devices and products. The course is meant to provide students hands-on experience with component sensing and computing technologies, a working knowledge of different materials and methods used in modern-day prototyping and manufacture, and exposure to people en-gaged in designing novel devices within the field of interactive device design. Activities will features a wide and evolving range of domains such as texile sensors, hacking wireless radio, making LED light sculptures, taking apart toys, shape deposition modeling and more.
EESS 208	Topics in Geobiology	1	Reading and discussion of classic and recent papers in the field of Geobiology. Co-evolution of Earth and life; critical intervals of environmental and biological change; geomicrobiology; paleobiology; global biogeochemical cycles; scaling of geobiological processes in space and time
EESS 212	Measurements in Earth Systems	4	Restricted to EESS first-year, graduate students. Techniques to track biological, chemical, and physical processes operating across the San Francisquito Creek watershed, encompassing upland, aquatic, estuarine, and marine environments. Topics include gas and water flux measurement, assessment of microbiological communities, determination of biological productivity, isotopic analysis, soil and water chemistry determination, and identification of rock strata and weathering processes.
EESS 244	Marine Ecosystem Modeling	3	Practical background necessary to construct and implement a 2-dimensional (space and time) numerical model of a simple marine ecosystem. Computer programming, model design and parameterization, and model evaluation. Students develop and refine their own multi-component marine ecosystem model.
EESS 249	Marine Stable Isotopes	3	This course will provide an introduction to stable isotopes biogeochemistry with emphasis on applications in marine science. We will cover fundamental concepts of nuclear structure and origin of elements and isotopes, and stable isotopic fractionation. We will discuss mass spectrometry techniques, mass independent fractionation, clumped isotopes, mass balance and box models. Applications of these concepts to studies of ocean circulation, marine carbon and nitrogen cycles, primary productivity, and particle scavenging will also be discussed.

EESS 250	Elkhorn Slough Microbiology	3	The microbial ecology and biogeochemistry of Elkhorn Slough, an agriculturally-impacted coastal estuary draining into Monterey Bay. The diversity of microbial lifestyles associated with estuarine physical/chemical gradients, and the influence of microbial activity on the geochemistry of the Slough, including the cycling of carbon, nitrogen, sulfur, and metals. Labs and field work.
EESS 301	Topics in Environmental Earth System Science	1	Current topics, issues, and research related to interactions that link the oceans, atmosphere, land surfaces and freshwater systems.
EESS 330	Advanced Topics in Hydrogeology	1-2	Topics: questioning classic explanations of physical processes; coupled physical, chemical, and biological processes affecting heat and solute transport.
EESS 43	The Global Warming Paradox III	1	Further discussion of the complex climate challenges posed by the substantial benefits of energy consumption, including the critical tension between the enormous global demand for increased human well-being and the negative climate consequences of large-scale emissions of carbon dioxide. Discussions explore topics of student interest, including peer-reviewed scientific papers, current research results, and portrayal of scientific findings by the mass media and social networks. Focus is on student engagement in on-campus and off-campus activities.
ENERGY 101A	Energizing California	1	A weekend field trip featuring renewable and nonrenewable energy installations in Northern California. Tour geothermal, bioenergy, and natural gas field sites with expert guides from the Department of Energy Resources Engineering.
ENERGY 104	Transition to Sustainable Energy Systems	3	This course explores the transition to a sustainable energy system at large scales (national and global), and over long time periods (decades). Explores the drivers of global energy demand and the fundamentals of technologies that can meet this demand sustainably. Focuses on constraints affecting large-scale deployment of technologies, as well as inertial factors affecting this transition. Problems will involve modeling global energy demand, deployment rates for sustainable technologies, technological learning and economics of technical change.
ENERGY 154	Energy in Transition: Technology, Policy, and Politics	2	The $6 trillion dollar global energy sector is in the midst of change; increasing global demand, retiring energy assets, and abundant technology choices are creating an atmosphere of commercial dynamism. What is clear is that decision-making in the energy sector is not simply based on technology attributes. Through the lenses of technology, policy, and politics, this class will consider how new and improved energy technologies actually make their way into the marketplace in the real world.

ENERGY 240	Geostatistics	2-3	Geostatistical theory and practical methodologies for quantifying and simulating spatial and spatio-temporal patterns for the Earth Sciences. Real case development of models of spatial continuity, including variograms, Boolean models and training images. Estimation versus simulation of spatial patterns. Loss functions. Estimation by kriging, co-kriging with secondary data. Dealing with data on various scales. Unconditional and conditional Boolean simulation, sequential simulation for continuous and categorical variables. Multi-variate geostatistical simulation. Probabilistic and pattern-based approaches to multiple-point simulation. Trend, secondary variable, auxiliary variable and probability-type constraints. Quality control techniques on generated models. Workflows for practical geostatistical applications in mining, petroleum, hydrogeology, remote sensing and environmental sciences.
ENERGY 246	Reservoir Characterization and Flow Modeling with Outrcrop Data	3	Project addressing a reservoir management problem by studying an outcrop analog, constructing geostatistical reservoir models, and performing flow simulation. How to use outcrop observations in quantitative geological modeling and flow simulation. Relationships between disciplines. Weekend field trip.
ENERGY 253	Carbon Capture and Sequestration	3-4	CO2 separation from syngas and flue gas for gasification and combustion processes. Transportation of CO2 in pipelines and sequestration in deep underground geological formations. Pipeline specifications, monitoring, safety engineering, and costs for long distance transport of CO2. Comparison of options for geological sequestration in oil and gas reservoirs, deep unmineable coal beds, and saline aquifers. Life cycle analysis.
ENERGY 260	Modeling Uncertainty in the Earth Sciences	3	Whether Earth Science modeling is performed on a local, regional or global scale, for scientific or engineering purposes, uncertainty is inherently present due to lack of data and lack of understanding of the underlying phenomena. This course highlights the various issues, techniques and practical modeling tools available for modeling uncertainty of complex 3D/4D Earth systems. The course focuses on a practical breath rather than theoretical depth. Topics covered are: the process of building models, sources of uncertainty, probabilistic techniques, spatial data analysis and geostatistics, grid and scale, spatio-temporal uncertainty, visualizing uncertainty in large dimensions, Monte Carlo simulation, reducing uncertainty with data, value of information. Applications to both local (reservoir, aquifer) and global (climate) are covered through literature study. Extensive software use with SGEMS and Petrel. Project homework.
ENERGY 271	Energy Infrastructure, Technology and Economics	3	Oil and gas represents more than 50% of global primary energy. In delivering energy at scale, the industry has developed global infrastructure with supporting technology that gives it enormous advantages in energy markets; this course explores how the oil and gas industry operates. From the perspective of these established systems and technologies, we will look at the complexity of energy systems, and will consider how installed infrastructure enables technology development and deployment, impacts energy supply, and how existing infrastructure and capital invested in fossil energy impacts renewable energy development.
ENERGY 301	The Energy Seminar	1	Interdisciplinary exploration of current energy challenges and opportunities, with talks by faculty, visitors, and students.

ENGLISH 151C	Wastelands	5	Beginning with a sustained examination of T.S. Eliot's "The Waste Land," this class will explore the trope of ecological and/or spiritual devastation as it enters into other modernist (Hemingway, Cather, Faulkner, O'Neill) and postmodernist (Ballard, Atwood, McCarthy) projects, tracing this theme to its culmination in the contemporary zombie apocalypse.
ENGLISH 175C	American Nature	5	This course will examine a wide range of American engagements with nature: as a determinant of national character and destiny, as a source of spiritual and moral revitalization, as a battleground for the survival of races and ethnicities, as a molding mechanism of citizenship, as the basis of a national art and culture, and as a resource for exploitation or preservation.
ENGR 118	Cross-Cultural Design for Service	3	Students spend the summer in China working collaboratively to use design thinking for a project in the countryside. Students learn and apply the principles of design innovation including user research, ideation, prototyping, storytelling and more in a cross cultural setting to design a product or service that will benefit Chinese villagers. Students should be prepared to work independently in a developing region of China, to deal with persistent ambiguity, and to work with a cross-cultural, diverse team of students on their projects.
ENGR 145	Technology Entrepreneurship	4	How do you create a successful start-up? What is entrepreneurial leadership in a large firm? What are the differences between an idea and true opportunity? How does an entrepreneur form a team and gather the resources necessary to create a great enterprise? This class mixes mentor-guided team projects, in-depth case studies, research on the entrepreneurial process, and the opportunity to network and ask questions of Silicon Valley's top entrepreneurs and venture capitalists. For undergraduates of all majors who seek to understand the formation and growth of high-impact start-ups in areas such as information, green/clean, medical and consumer technologies.
ENGR 30	Engineering Thermodynamics	3	The basic principles of thermodynamics are introduced in this course. Concepts of energy and entropy from elementary considerations of the microscopic nature of matter are discussed. The principles are applied in thermodynamic analyses directed towards understanding the performances of engineering systems. Methods and problems cover socially responsible economic generation and utilization of energy in central power generation plants, solar systems, refrigeration devices, and automobile, jet and gas-turbine engines.
ENGR 50E	Introduction to Materials Science - Energy Emphasis	4	Materials structure, bonding and atomic arrangements leading to their properties and applications. Topics include electronic, thermal and mechanical behavior; emphasizing energy related materials and challenges.
ENVRES 205	Exploring Environmental Learning and Environmental Behavior	1-2	Exploration of foundational and more recent literature addressing environmental learning and environmental behavior, both as separate and intersecting concepts. Critical reading and active discussions contributing to broader and deeper understanding of how environmental learning occurs in a variety of settings and with a range of audiences, and how this environmental learning might - or might not - contribute to environmental behavior.

ENVRES 277C	Specialized Writing and Reporting: Environmental Journalism	4-5	Practical, collaborative, writing-intensive course in science-based environmental journalism. Science and journalism students learn how to identify and write engaging stories about environmental issues and science, how to assess the quality and relevance of environmental news, how to cover the environment and science beats effectively, and how to build bridges between the worlds of journalism and science. Limited enrollment: preference to journalism students and students in the natural and environmental sciences.
ENVRES 290	Capstone Project Seminar in Environment and Resources	1-3	Required for E-IPER Joint M.S. students. Propose, conduct and publicly present final individual or team projects demonstrating the integration of professional (M.B.A., J.D., or M.D.) and M.S. in Environment and Resources degrees. Presentation and submission of final product required.
ENVRES 310	Environmental Forum Seminar	1-2	Conceptual frameworks, analytical approaches, validity of conclusions from an interdisciplinary perspective. Participants attend various environmentally-focused seminars on campus selected by faculty and students, followed by student-facilitated discussions.
ENVRES 315	Environmental Research Design Seminar	1-2	Required core course for first year E-IPER Ph.D. students; optional for Joint M.S. students; other graduate students with instructor's permission. Series of faculty presentations and student-led discussions on interdisciplinary research design as exemplars of the research design theories discussed in ENVRES 320. Designing Environmental Research. Topics parallel the ENVRES 320 syllabus.
ENVRES 320	Designing Environmental Research	3-4	Required core course restricted to first year E-IPER Ph.D. students. Research design options for causal inference in environmentally related research. Major philosophies of knowledge and how they relate to research objectives and design choices. Identification of critical elements within a broad range of research designs. Evaluation of the types of research questions for which different designs are suited, emphasizing fit between objectives, design, methods, and argument. Development of individual research design proposals, including description and justification understandable to a non-specialist.
ENVRES 330	Research Approaches for Environmental Problem Solving	3	Required core course for first year E-IPER Ph.D. students. How to develop and implement interdisciplinary research in environment and resources. Assignments include development of research questions, a preliminary literature review, and a summer funding proposal. Course is structured on peer critique and student presentations of work in progress.
ENVRES 380	Collaborating with the Future: Launching Large Scale Sustainable Transformation	3-4	This project-based d.school class combines Design Thinking Processes, Behavioral Sciences, and elements of Diffusion Theory. Tools and theories introduced in class will be used to structure large-scale transformations that simultaneously create value on environmental, societal, and economic fronts. We encourage students to use this class as a launching pad for real initiatives.

ENVRINST 220	The Social Ocean: Ocean Conservation, Management, and Policy	1-2	This interdisciplinary seminar examines current ocean issues and ideas through a series of readings, discussions, and guest lecturer presentations of seminal works about ethical, physical, and emotional relationships of human beings to the marine world. Through the lenses offered by several classic readings, we will examine and reinterpret the challenges of fisheries collapse, climate change, shipping, marine spatial planning, biodiversity conservation, and the management of land-sea interactions. Though the seminar is open to all undergraduate and graduate students, our course is designed especially for those with a particular interest in studying and solving key issues of ocean policy and management, from coastal adaption to fisheries management to cumulative impacts assessments. In addition to this interest, students must be willing to take the time to dig deeper into the foundations of environmental thinking about the relationship of human beings and the sea.
ETHICSOC 184M	Population Ethics	4	This course examines the ethical issues that surround the decision to have a child. These issues are both private and public. For example, should we even have children knowing the environmental impacts of doing so? What kinds of population policies can the state legitimately enforce? Can it legitimately forbid parents from having more than one child? Can it adopt policies to promote a larger population? Other questions the course will consider include: Is the genetic engineering of children acceptable? Can it be permissible to use abortion as a means of sex selection? If one does have children, who ought pay the costs of supporting them?
ETHICSOC 278M	Introduction to Environmental Ethics	5	This course examines the following ethical questions about the environment: (1) how we ought morally to relate to animals; (2) attempts to expand the circle of moral concern beyond animals to other parts of nature; (3) economic approaches to environmental problems (e.g. cost-benefit analysis) and the justification of the precautionary principle; and (4) our moral obligations to future people. The class will conclude by considering whether the theoretical tools that we have examined help to address the problems of climate change, one of the most pressing environmental challenges of our time.
FEMST 106	Queer Studies Colloquium	1	What is Queer Studies? What kind of work is being done in Queer Studies at Stanford and beyond? Weekly interdisciplinary lectures focus on issues of gender, sexuality, and queer theory. Scholars across programs and departments cover topics such as international queer social movements, queer literary studies, and queer theory and the environment, among others. No prior knowledge of Queer Studies required.
FRENCH 228	Science, Technology, and Society in the Face of the Looming Disaster	3-5	The major topic will be the indeterminacy regarding the survival of humankind. With the advent of the atomic bomb humankind became potentially the maker of its own demise. Will combine a number of significant case studies (environmental disasters, industrial catastrophes, threat of nuclear devastation, technological risks) with the lessons drawn from a form of literature that is at the intersection of STS and the Humanities, in particular the early warnings made by such thinkers as Ivan Illich, Martin Heidegger, Hans Jonas, Günther Anders, and Hannah Arendt.

GENE 243	Intellectual Property: Scientific Evidence in Patent Litigation	3	Open to clinical MD and graduate students. Explores the role of scientific experts in patent infringement litigation. In other areas of the law where scientific experts are used -- medical malpractice, environmental law, criminal law -- the science itself is often in dispute. In patent cases, however, the parties generally agree on the science. This affects the relationship between the lawyer and the expert and the substantive content of their interactions. Patent experts need to be able to explain science to the judge and jury. But they also must help the litigators choose which legal issues to press and which to concede, and to be aware of how the complications of the science might help, hurt, obscure or reveal how the law should be applied to the facts. The class examines judicial decisions and trial documents involving scientific evidence in patent litigation, followed by work in teams on final projects: simulations of expert testimony in a patent case. Simulations are performed at the end of the quarter before panels of practicing patent lawyers.
GEOPHYS 110	Earth on the Edge: Introduction to Geophysics	3	Introduction to the foundations of contemporary geophysics. Topics drawn from four broad themes in: whole Earth geodynamics, geohazards, natural resources, and environment/sustainability. In each case the focus is on how the interpretation of a variety of geophysical measurements (e.g., gravity, seismology, heat flow, magnetism, electromagnetics, and geodesy) can be used to provide fundamental insight into the behavior of the Earth's complex geosystems
GEOPHYS 201	Frontiers of Geophysical Research at Stanford: Faculty Lectures	1	Required for new students entering the department. Second-year and other graduate students may attend either for credit or as auditors. Department faculty and senior research staff introduce the frontiers of research problems and methods being employed or developed in the department and unique to department faculty and students: what the current research is, why the research is important, what methodologies and technologies are being used, and what the potential impact of the results might be.
GEOPHYS 60N	Man vs. Nature: Coping with Disasters Using Space Technology	4	Preference to freshman. Natural hazards, earthquakes, volcanoes, floods, hurricanes, and fires, and how they affect people and society; great disasters such as asteroid impacts that periodically obliterate many species of life. Scientific issues, political and social consequences, costs of disaster mitigation, and how scientific knowledge affects policy. How spaceborne imaging technology makes it possible to respond quickly and mitigate consequences; how it is applied to natural disasters; and remote sensing data manipulation and analysis.
GES 102L	Introductory Mineralogy Laboratory	1	One weekly 3-hour laboratory to identify and interpret rock-forming minerals, industrially important minerals, and gems. Introduction to the use of hand lens, petrographic microscope and x-ray diffraction.
GES 104L	Introductory Petrology Laboratory	1	One weekly 3-hour laboratory on how to identify igneous, metamorphic, and sedimentary rocks, and interpret their mode and conditions of formation using hand lens and petrographic microscope.

GES 130	Soil Physics and Hydrology	3	The occurrence, distribution, circulation, and reaction of water at the surface and within the near surface. Topics: precipitation, evapotranspiration, infiltration and vadose zone, groundwater, surface water and streamflow generation, and water balance estimates. Current and classic theory in soil physics and hydrology. Urban, rangeland, and forested environments.
GES 131	Hydrologically-Driven Landscape Evolution	3	Materials of the Earth and hydrologically driven landscape processes. Topics: hillslope hydrology, weathering of rocks and soils, erosion, flow failures, mass wasting, and conceptual models of landscape evolution. Current and classic theory in geomorphology.
GES 150	Senior Seminar: Issues in Earth Sciences	3	Focus is on written and oral communication in a topical context. Topics from current frontiers in earth science research and issues of concern to the public. Readings, oral presentations, written work, and peer review.
GES 183	California Desert Geologic Field Trip	1	Field seminar. Four class meetings during Winter quarter followed by a 6-day field trip over Spring Break to Mojave Desert, Death Valley, and Owens Valley. Basin-and-range faulting, alluvial fans, playas, sand dunes, metamorphic rocks, granites of the Sierra Nevada, lava flows and and the deposits of supervolcanic eruptions, hot springs, ore deposits, and desert landscapes. Involves camping and moderate hiking.
GES 191	GES Field Trips	1	Four- to seven-day field trips to locations of geologic and environmental interest. Includes trips offered during Thanksgiving and Spring breaks.
GES 1B	Introduction to Geology: California Desert Geology	4	For non-majors and prospective majors or minors in the Earth Sciences. The landscapes and rock formations of California's Death Valley and Owens Valley are used as natural laboratories for studying active geologic processes that shape Earth's surface (earthquakes, mountain building, volcanoes, glaciers) and for tracing a billion years of Earth history, climate change, and historic human impacts. Lectures on these topics and hands-on laboratory exercises involving rock identification and interpreting topographic and geologic maps and satellite imagery provide an introduction to physical geology and the background necessary to appreciate an optional 6-day field trip to these desert areas during Spring Break that can be taken separately as GES183.
GES 221	What Makes a Habitable Planet?	3	Physical processes affecting habitability such as large impacts and the atmospheric greenhouse effect, comets, geochemistry, the rise of oxygen, climate controls, and impact cratering. Detecting and interpreting the spectra of extrasolar terrestrial planets. Student-led discussions of readings from the scientific literature. Team taught by planetary scientists from NASA Ames Research Center.
GES 253	Petroleum Geology and Exploration	3	The origin and occurrence of hydrocarbons. Topics: thermal maturation history in hydrocarbon generation, significance of sedimentary and tectonic structural setting, principles of accumulation, and exploration techniques.
GES 290	Departmental Seminar in Geological and Environmental Sciences	1	Current research topics. Presentations by guest speakers from Stanford and elsewhere.
GES 291	GES Field Trips	1	Field trips for teaching and research purposes. Trips average 5-10 days.

GES 43Q	Environmental Problems	3	Preference to sophomores. Components of multidisciplinary environmental problems and ethical questions associated with decision making in the regulatory arena. Students lead discussions on environmental issues such as groundwater contamination from point and nonpoint sources, cumulative watershed effects related to timber and mining practices, acid rain, and subsurface disposal of nuclear waste.
GES 5	Living on the Edge	1	A weekend field trip along the Pacific Coast. Tour local beaches, geology, and landforms with expert guides from the Department of Geological and Environmental Sciences. Enjoy a BBQ dinner and stay overnight in cabins along the Santa Cruz coast. Get to know faculty and graduate students in the Earth Sciences.
GES 55Q	The California Gold Rush: Geologic Background and Environmental Impact	3	Preference to sophomores. Topics include: geologic processes that led to the concentration of gold in the river gravels and rocks of the Mother Lode region of California; and environmental impact of the Gold Rush due to population increase, mining operations, and high concentrations of arsenic and mercury in sediments from hard rock mining and milling operations.
GES 7A	An Introduction to Wilderness Skills	1	Living, traveling, and working in the wilderness for those planning fieldwork in the back country. Local geology, environmental ethics, trip planning, first aid, and leadership techniques. Four mandatory weekend outings focus on back country travel, minimum impact camping, equipment use and maintenance, rock climbing, and navigation. 7A emphasizes wilderness travel and climbing. Food, group, and major personal gear provided. Guest speakers.
GES 7B	An Introduction to Wilderness Skills	1	Living, traveling, and working in the wilderness for those planning fieldwork in the backcountry. Local geology, environmental ethics, trip planning, first aid, and leadership techniques. Four mandatory weekend outings focus on backcountry travel, minimum impact camping, equipment use and maintenance, rock climbing, and navigation. 7B emphasizes winter camping skills and backcountry skiing. Food, group, and major personal gear provided. Guest speakers.
GES 7C	Advanced Wilderness Skills	1	For students with prior backcountry experience. Backcountry skiing, mountaineering, climbing, first aid, and trip planning. Focus is on outdoor leadership experience and trip management techniques. Food, group, and major personal gear provided. Four mandatory weekend trips.
GES 90	Introduction to Geochemistry	3-4	The chemistry of the solid earth and its atmosphere and oceans, emphasizing the processes that control the distribution of the elements in the earth over geological time and at present, and on the conceptual and analytical tools needed to explore these questions. The basics of geochemical thermodynamics and isotope geochemistry. The formation of the elements, crust, atmosphere and oceans, global geochemical cycles, and the interaction of geochemistry, biological evolution, and climate.

GSBGEN 313	Advanced Seminar on Social Entrepreneurship and Global Poverty	3	As an "advanced" seminar, this course is designed for students with strong backgrounds or interests in social entrepreneurship as a tool for solving social problems. The learning format is based on active engagement. For most of the classes, students will be required to lead off the class discussions. The ultimate goal of this course is to make students (and the instructor) smarter about the strengths and limits of social entrepreneurship as a tool for social change. To this end, we will focus on global poverty reduction as a testing ground. During this process we will explore different theories, concepts, frameworks, and guidelines for effective social entrepreneurship to see whether, when and how these help. nnnThe course is organized into three modules. The first focuses on how social entrepreneurship fits in a broader framework of social change and social innovation. The second module provides a brief overview of issues, debates, and theories about poverty and development. The third module focuses on specific entrepreneurial interventions aimed at addressing some of the conditions that keep people poor or make them poor. nnnThis course allows us to dig into the complexities and challenges of effective social entrepreneurship. It will be taught in a discussion style. The reading will be demanding. So if you are not prepared to dig into the reading or to engage in active discussion, or if you don't feel like you bring relevant knowledge to add to the mix of discussion, this is not the course for you. It is not meant to be an introduction to social entrepreneurship. If everyone contributes, we will all emerge from the course with new perspectives and frameworks for advancing practice in this field. Only take this course if you are ready for an intellectual adventure and ready to make the investment it requires.

GSBGEN 314	Creating High Potential Ventures in Developing Economies	3	This course addresses the distinctive challenges and opportunities of launching high-potential new ventures in developing economies. Developing economies are attractive targets for entrepreneurs because many of these markets are just starting to move up the growth curve. They offer low-cost operating environments and can be great development laboratories for potentially disruptive innovations. They increase in attractiveness when their political institutions stabilize and they become more market-friendly. At the same time, developing economies pose serious challenges. Pioneering entrepreneurs take on significant risks to gain early mover advantages. Specifically, they will not be able to count on the same kind of supportive operating environments that we take for granted in the developed world. They often face cumbersome permit and licensing processes, poorly developed financial and labor markets, problematic import and export procedures, unreliable local supply chains, weak infrastructure, petty corruption, currency risks, and more. The course is designed to help would-be entrepreneurs better understand and be prepared for the complex issues as they pursue the opportunities and address the challenges to start, grow, and harvest or exit their ventures in these environments. The core of the course is an intense team-based exercise involving the development of a new venture proposal for a particular developing country. While a detailed business plan will not be required, in depth analysis and recommendations for next steps will be. In effect, the team will answer the question: why do they think this new proposed venture is viable in the specific developing economy/country, and how would the group go about actually starting and growing the business? We will come with frameworks, readings, and cases, but this is an arena that begs for new approaches and material. We will be refining and developing our approaches as we go, with heavy student input. This course will relate to the work being done in the Stanford Institute for Innovation in Developing Economies (SEED), under the theory that healthy entrepreneurship and innovation will improve the overall economy and (at least indirectly, if not directly) reduce poverty. Helping entrepreneurs build successful new ventures in a developing economy is an essential element of an overall strategy for moving a country out of poverty. BoP businesses have tended to grow slowly, and struggle to raise capital, often be forced to pay low wages, etc. Without complementing these businesses with strong high-potential, high-growth, profit making businesses, none of these developing economies will progress economically or eliminate poverty. A prosperous business with a solid plan will help the country, the economy, and ultimately the poor.

GSBGEN 336	Energy Markets and Policy	4	Transforming the global energy system to reduce climate change impacts, ensure security of supply, and foster economic development of the world's poorest regions depends on the ability of commercial players to deliver the needed energy at an affordable price at scale. Technological innovation is a necessary but not sufficient condition for this to occur. The complex institutional frameworks that regulate energy markets in the United States and around the world will play a major role in determining the financial viability of firms in the energy sector. In this course we survey the economic, regulatory and technological constraints facing energy enterprises of all types and consider what kinds of business models work in each setting. We study in detail how markets function for carbon (assessing the advantages and disadvantages of different policy tools and considering in particular California?s implementation of A.B. 32); electricity markets (with a focus on understanding how both retail and wholesale electricity prices are determined and how market participants hedge short-term price risk); renewable energy technologies (focusing on ways to manage intermittency and on how renewable energy businesses respond to government incentives); nuclear power (as a case study of how the regulatory process affects investment decisions); oil and natural gas (treating both conventional and unconventional resources and emphasizing the key role of risk management in an industry characterized by uncertainty and high capital requirements); transportation fuels (discussing biofuels incentives, fuel efficiency standards, and other policy tools to lower carbon intensity in the transportation sector); and energy for low-income populations, for which affordability and distribution pose special challenges. The objective of the course is to provide a robust intellectual framework for analyzing how a business can most constructively participate in any sector like energy that is heavily affected by government policy.
GSBGEN 381	Strategic Philanthropy	3	Appropriate for any student driven to effect positive social change from either the for-profit or nonprofit sector, Strategic Philanthropy (GSBGEN 381/ EDUC 377C) will challenge students to expand their own strategic thinking about philanthropic aspiration and action. In recent decades, philanthropy has become an industry in itself - amounting to nearly $300 billion in the year 2011. Additionally, the last decade has seen unprecedented innovation in both philanthropy and social change. This course explores the key operational and strategic distinctions between traditional philanthropic entities, such as community foundations, private foundations, and corporate foundations; and innovative models, including funding intermediaries, open-source platforms, technology-driven philanthropies, and venture philanthropy partnerships. Course work will include readings and case discussions that encourage students to analyze both domestic and global philanthropic strategies as they relate to foundation mission, grant making, evaluation, financial management, infrastructure, knowledge management, policy change, and board governance. Guest speakers will consist of high profile philanthropists, foundation presidents, social entrepreneurs and Silicon Valley business leaders creating new philanthropic models. The course will culminate in an individual project in which students will complete a business plan for a $10 million private foundation.

GSBGEN 507	Impact Investing: Strategies and Tools	2	This course will explore how investment capital and financial tools can be applied to deliver both financial returns and impact (benefit) for our communities and environment. The class will be organized around a set of guest lectures from impact investing firms across a spectrum of investment strategies & returns expectations. Through these examples, we'll explore how impact investing is applying the basics of investing to different objectives: arbitraging market inefficiencies; valuing and pricing risk; determining how each party in a transaction may see the value created on different scales and aligning these objectives; the role of public policy in these markets. The class will emphasis applying these concepts and examples to create, in groups, your own impact investment fund or instrument.
GSBGEN 512	Funding Social Impact: Methods and Measurement	2	Traditional philanthropy consists of outright grants to organizations to achieve the grantors' social and environmental objectives. However, the past decade has seen an increasing interest in impact investments--financial investments that seek to generate monetary returns at the same time as they further the investors' social objectives. Throughout the course, we ask: how investors can (1) measure the social impact of the organizations they invest in, and (2) assess whether their own loans or capital contributions actually make a difference in increasing the organizations' impact. We begin by reviewing the domains from which impact investing draws: grantmaking to maximize social impact and financial investing to maximize financial return. We then consider examples of impact investing, ranging from below-market equity investments and loans, to investments intended to create social value while achieving risk-adjusted market returns or better. We consider the role of impact investing at various stages, from R&D to start-ups to growing and mature enterprises. We explore these issues through case studies of impact investing both in the U.S. and developing countries. We examine how investors can identify and assess impact investments, the information, knowledge and skills needed to make impact investments, and the role of fund managers and advisors. We also consider novel impact investing vehicles, such as social impact bonds and B-corporations. Time permitting, we will also touch on the related issue of using negative screens for socially responsible investing
GSBGEN 532	Cleantech: Business Fundamentals and Public Policy	2	This course examines trends in the cleantech sector related to energy and carbon emissions with an emphasis on the interaction between technological developments, economic fundamentals and regulatory policy. We develop a framework to compare the cost competitiveness of alternative energy sources including low-carbon fossil fuels, solar power and biofuels. The final part of the course will focus on issues of technology commercialization, in particular the 'Valley of Death' and the emerging role of information technology for the cleantech sector.

GSBGEN 533	Sustainability as a Market Strategy	2	The increasing social emphasis on environmental sustainability creates both dilemmas and opportunities for firms. Recognizing that sustainability means a focus on not just the environment, but also on broader issues of corporate social responsibility, we will examine the ways in which some companies are developing a "sustainability strategy." We will also consider the way in which companies are profiting from such a strategy with an eye toward understanding the conditions under which such a strategy can generate profits for firms. We will also focus on the way in which many companies are partnering with non-governmental organizations to develop business strategies that focus not only on profits, but also on the environment and social responsibility.
GSBGEN 537	The Role of Business in Sustainable Food Systems	1	The food system in the United States has contributed to a number of societal and ecological problems, from increasing rates of diet- and food-related illnesses, to "food deserts" in our inner cities, to the loss of farmland to urban sprawl, to agricultural chemical runoff into our water sources, to unjust farm labor practices, to the overuse of antibiotics, to an enormous amount of food waste, to questionable animal husbandry practices, and more generally to a diminishing level of diversity among the people, plants, and animals on whom we rely for our sustenance. These problems create both dilemmas and opportunities for business. This course will focus on how some companies (both for-profit and non-profit) are working to try to repair the damaged food system in the United States. Topics include (but are not limited to): organic and biodynamic agriculture, the economic demise of the family farm, the health effects of our current system of food production and the habits it has engendered, and opportunities for entrepreneurship and new modes of food distribution. We will have several guest speakers, field trips, and cooking/food preparation workshops and demonstrations.
GSBGEN 538	Energy Policy, Markets, and Climate Change	2	This course will consider world energy markets as well as national and international policy challenges for the energy sector, in the context of climate change and its probable impacts. Case studies, readings, and class discussions will explore the history of fossil fuel price changes and their effects on trade, the influence of subsides and tax incentives on the prospects for renewable alternative sources, and the role of governments in setting import and export policies. The class will consider such questions as: What policies are adopted when energy developments confront other land values, or are associated with human or environmental risks? What role do Public Utility Commissions play and how do international agreements influence the sector? How do new technologies for improving energy yield, building efficiency, and transportation affect use? What is the role of regulation in establishing patterns of energy use? Cases may require students to play such roles as: (1) an executive director of an environmental non-governmental organization considering approval for construction of a large solar-thermal facility in the Mojave Desert; (2) the chief executive officer of a company drilling shale deposits for natural gas developing his case for a governor; (3) a Senator evaluating her position on converting a port to permit US coal to be exported to China.

GSBGEN 567	SEEDing Change: Approaches and Innovations in Poverty Alleviation	2	This Bass Seminar is an opportunity to help lay the foundation for the GSB's new initiative on poverty alleviation in developing economies, the Stanford Institute for Innovation in Developing Economies (nicknamed SEED). Following an introduction to the major approaches to poverty alleviation and the role of entrepreneurial activity, the course will be a student-driven seminar. Groups of students will work on focused projects of their choosing within the confines of SEED's mission, which is to stimulate, develop, and disseminate research and innovations that enable entrepreneurs, managers, and leaders to alleviate poverty in developing economies. A particular focus will be given to exploring and assessing the different ways in which SEED can most effectively help entrepreneurs in developing countries grow and scale. Project deliverables can take a variety of forms, including business plans, proofs of concept, case studies, teaching notes, etc.
GSBGEN 578	Decisions About the Future	2	How should you decide between now and the future? This course will cover the descriptive and prescriptive theories of intertemporal choice in psychology and economics. Topics will include financial decision making, social (who should you marry?), environmental, and health. The goal of the course is to maximize the long term happiness and effectiveness of yourself and others. Grading will be based on: class participation, a decision diary (in three parts), and an exam.
GSBGEN 585	Social Innovation through Corporate Social Responsibility	2	This course accepts that the (CSR) movement linking business, communities and sustainability has moved past the stage of debate. The last decade has seen an increased awareness in regard to environmental and social issues that has found its way up the corporate ladder and into company boardrooms. How companies incorporate CSR programs and strategies, however, is varied and diverse. The course will utilize reading assignments, case analysis and/or company presentations to provide an overview of CSR, the frameworks and models for developing a CSR strategy and the growing utilization of cross-sector partnerships in CSR and innovation efforts. Particular focus will be on cutting edge business strategies for squaring social and environmental responsibilities with competitive demands. The latter part of the course will examine the role of cross-sector partnerships as a critical lever. Cross-sector collaboration is increasingly desirable as a strategy for addressing many of society's problems; however, research evidence indicates that it is hardly easy. Guests will bring to life the challenges and rewards in working collaboratively to implement social change.

GSBGEN 586	Poverty, Entrepreneurship, and Development	2	Global poverty is a problem that persists on a massive scale, and its persistence may itself be a major impediment to growth in emerging economies. Recent years have seen a blossoming interest in socially innovative approaches to alleviating poverty and stimulating economic growth in emerging economies. In this short course, we will explore different conceptualizations of the problem of global poverty, the potential role of entrepreneurship in helping to address it, as well as the strengths and weaknesses of different approaches. Some possible areas of focus include: different conceptualizations of the main drivers of persistent, extreme poverty; the challenges to entrepreneurship posed by the institutional environments of emerging economies; the appropriate role of entrepreneurship as a means of addressing the concerns of the poor; the pros and cons of different models (e.g., venture philanthropy, social enterprise, non-profit); ethical issues and concerns associated with different strategies. In addition to reading and in-class discussion, the course will also draw on the expertise and experiences of one or more guest speakers.
HISTORY 243C	Colonial Science and Medicine	4-5	Explores the global exchange of knowledge, technologies, plants, peoples, disease, and medicines. Colonial sciences and medicines were important militarily and strategically for positioning emerging nation states in global struggles for land and resources. Considers primarily French, British, and Dutch in the West Indies, but also takes examples from Iberian, Jesuit, and other traditions in China and India. Readings treat science and medicine in relation to voyaging, colonialism, slavery, plants, and environmental exchange.
HISTORY 254	Popular Culture and American Nature	5	Despite John Muir, Aldo Leopold, and Rachel Carson, it is arguable that the Disney studios have more to do with molding popular attitudes toward the natural world than politicians, ecologists, and activists. Disney as the central figure in the 20th-century American creation of nature. How Disney, the products of his studio, and other primary and secondary texts see environmentalism, science, popular culture, and their interrelationships.
HISTORY 260E	Environmental Policy and the City in US History	5	Looks at the historical backgrounds of current issues in urban environmental policy, including waste, transportation, air pollution, and other major issues. Covers the period 1800 to the present. Explores the relevance of historical scholarship.
HISTORY 283	The New Global Economy, Oil, and Islamic Movements in the Middle East	4-5	The integration of the Middle East into the world capitalist market on a subordinate basis and the impact on economic development, class formation, and politics. Alternative theoretical perspectives on the rise and expansion of the international capitalist market combined with case studies of Egypt, Iraq, and Palestine.
HISTORY 291F	Yangtze: Nature, History, and the River	5	Topics include the natural history, social and economic development, and cultural construction as well as the changes to the river from the huge Three Gorges Dam and the plans for massive water transfers from the Yangtze to ever-thirstier Beijing and north China.
HISTORY 307B	Environment, Technology, and Revolution in World History	4-5	Exploration of historiographical and interdisciplinary methodologies and approaches to intersections among environmental, technological, and revolutionary social change in diverse geographical and temporal contexts. Readings include broad theoretical and synthetic works as well as case studies of American, French, Mexican, Russian, Chinese, and Hungarian revolutions.

HISTORY 462A	Political Economy	4-5	Graduate Research Seminar centered broadly on political economy, which is undergoing something of a resurgence. Political economy can cover the new cultural history of capitalism, economics and environmental change, race and gender and the economy as well as more traditional topics.
HISTORY 462B	Political Economy	4-5	Graduate Research Seminar centered broadly on political economy, which is undergoing something of a resurgence. Political economy can cover the new cultural history of capitalism, economics and environmental change, race and gender and the economy as well as more traditional topics.
HISTORY 79S	From Coffee to Cocaine: Commodities, Society, and Environment in Modern South America	5	The relationship between South Americans and their natural environments. 19th and 20th centuries. Focus on commodity production and natural resources. Topics include: coffee and water (Brazil); wool (Argentina); guano (Peru); rubber and cattle (Amazon); cocaine (Andes); salmon (Chile). What are the environmental consequences of economic cycles of boom and bust? What is the role of environment in these cycles? Is human-caused environmental change permanent? Readings include primary and secondary sources. Last two weeks are dedicated to Spatial History (GIS).
HISTORY 91C	Early Imperial China	3	The first millennium of imperial China, what endured over the centuries, and the major changes that took place in the political, social, and intellectual realms. Topics include the evolving geographic and environmental background, cities, the countryside, kinship, relations with the outer world, religion, philosophy,and literature. Also examines the nature of empire as a distinctive political form.
HISTORY 91D	China: The Northern and Southern Dynasties	3	Examines one of the most dynamic periods of Chinese history with the emergence of the institutional religions (Buddhism and Daoism), the development of the garden as an art form, the rise of landscape as a theme of verse and art, the invention of lyric poetry, and the real beginnings of the southward spread of Chinese civilization.
HRP 231	Epidemiology of Infectious Diseases	3	Principles of the transmission of the infectious agents (viruses, bacteria, rickettsiae, mycoplasma, fungi, and protozoan and helminth parasites). The role of vectors, reservoirs, and environmental factors. Pathogen and host characteristics that determine the spectrum of infection and disease. Endemicity, outbreaks, and epidemics of selected infectious diseases. Principles of control and surveillance.
HRP 238	Genes and Environment in Disease Causation: Implications for Medicine and Public Health	2-3	The historical, contemporary, and future research and practice among genetics, epidemiology, clinical medicine, and public health as a source of insight for medicine and public health. Genetic and environmental contributions to multifactorial diseases; multidisciplinary approach to enhancing detection and diagnosis. The impact of the Human Genome Project on analysis of cardiovascular and neurological diseases, and cancer. Ethical and social issues in the use of genetic information.

HUMBIO 122	Beyond Health Care: Seeking Health in Society	3	Available evidence at the national and cross-country level linking social welfare interventions and health outcomes. If and how non-health programs and policies could have an impact on positive health outcomes. Evaluation of social programs and policies that buffer the negative health impact of economic instability and unemployment among adult workers and their children. Examination of safety nets, including public health insurance, income maintenance programs, and disability insurance.
HUMBIO 123	Obesity in America: Clinical and Public Health Implications	3-4	Interdisciplinary clinical, research, and policy approaches. The prevalence, predictors, and consequences of obesity and diabetes; biological and physiological mechanisms; clinical treatments including medications and surgery; and the relevance of behavioral, environmental, economic, and policy approaches to obesity prevention and control.
HUMBIO 126	Promoting Health Over the Life Course: Multidisciplinary Perspectives	3	Disease prevention and health promotion topics pertinent to different stages of the life span emphasizing healthy lifestyle and reducing risk factors in both individuals and communities. Focus is on scientific investigation, the application of behavioral science to risk reduction strategies, and the importance of health promotion as a social and economic imperative. Topics include: epidemiology of chronic diseases; social determinants of health, behavior change; obesity, nutrition, and stress; young adult, mid-life and aging health issues; health care delivery and public health system; workplace wellness programs; and environmental and international issues.
HUMBIO 127A	Community Health: Assessment and Planning I	4	Major determinants of health in a community. Working with community partners to identify health issues and plan programs and policies to prevent disease and promote health. Service learning component involving students in community health assessment techniques. Final grade given upon completion of HUMBIO 127B. Service Learning Course (certified by Haas Center).
HUMBIO 127B	Community Health: Assessment and Planning II	4	Continuation of 127A. Service learning course with emphasis on conducting community health assessment and planning projects in collaboration with community-based organizations. Service Learning Course (certified by Haas Center).
HUMBIO 128	Community Health Psychology	4	Social ecological perspective on health emphasizing how individual health behavior is shaped by social forces. Topics include: biobehavioral factors in health; health behavior change; community health promotion; and psychological aspects of illness, patient care, and chronic disease management.
HUMBIO 153	Parasites and Pestilence: Infectious Public Health Challenges	4	Parasitic and other pestilence of public health importance. Pathogenesis, clinical syndromes, complex life cycles, and the interplay among environment, vectors, hosts, and reservoirs in historical context. Public health policy initiatives aimed at halting disease transmission. World Health Organization tropical disease targets including river blindness, sleeping sickness, leishmaniasis, schistosomiasis, mycobacterial disease (tuberculosis and leprosy), malaria, toxoplasmosis, dracunculiais, and intestinal helminthes. Guest lecturers with expertise in disease control.

HUMBIO 166	Food and Society: Exploring Eating Behaviors in Social, Environmental, and Policy Context	4	The class examines the array of forces that affect the foods human beings eat, and when, where, and how we eat them, including human labor, agriculture, environmental sustainability, politics, animal rights/welfare, ethics, policy, culture, economics, business, law, trade, and ideology, and psychology. The class addresses the impact of current policies and actions that might be taken to improve human nutrition and health; macro-scale influences on food, nutrition, and eating behavior.
HUMBIO 170	Justice, Policy, and Science	5	The role of science in civil rights, justice, policy, criminal justice, evidence, education, and disabled rights.
HUMBIO 176	Impact of Infectious Diseases on Human History	3	Impact of infectious diseases on human society. Some topics include: Plague of Justinian and 14th century; impact on exploration, trade and conquest; how slavery, malaria and yellow fever conspired to alter the New World; Microbes and war; diseases of poverty, tuberculosis and others; Cholera and public health; pandemic influenza; diseases of human progress. Students give a 30 minute presentation on a topic of their choosing that exemplifies an aspect of the impact of politics, societal influences, religion or other forces on infectious diseases.
HUMBIO 2B	Culture, Evolution, and Society	5	Introduction to the evolutionary study of human diversity. Hominid evolution, the origins of social complexity, social theory, and the emergence of the modern world system, emphasizing the concept of culture and its influence on human differences.
HUMBIO 4B	Environmental and Health Policy Analysis	5	Connections among the life sciences, social sciences, public health, and public policy. The economic, social, and institutional factors that underlie environmental degradation, the incidence of disease, and inequalities in health status and access to health care. Public policies to address these problems. Topics include pollution regulation, climate change policy, biodiversity protection, health care reform, health disparities, and women's health policy
HUMBIO 80N	From Farm to Fork: The Science and Practicum of Growing and Cooking Food	3	The science and the practice of growing and preparing nourishing food. Course imparts gardening and cooking skills and explores theoretical topics including the evolution and ecology of agricultural systems; reproductive biology, chemistry, and culinary properties of plants; plant-insect interactions; and modern food systems and their health and environmental consequences. Class meetings alternate between classroom discussions and practical experiences at the Stanford Farm and the Arrillaga Dining Commons.
HUMBIO 81Q	Introduction to Child Nutrition	3	This course examines contemporary child nutrition in America, from the level of the intestinal villus to the food marketing directed at children, as well as the diseases associated with inappropriate nutrition. Students will obtain an understanding of what constitutes a healthy diet for growth and how dietary needs change throughout childhood and adolescence. We will review existing community and school-based nutrition interventions as well as pertinent literature on child nutrition. Students will also gain practical experience in healthy food preparation, emphasizing a seed-to-table approach.
HUMBIO 96N	Injustice, Advocacy, and Courage: The Path of Everyday Heroes	3	This course will study the paradigms of people of courage, action and energy who have fought against injustice by advocating for causes against great odds and at personal risk. The focus will be on everyday people who have taken action, often at great personal risk, not for ambition, but because of their convictions and steadfast commitment to their beliefs.

ILAC 345	Biopolitics and Sovereignty in Andean Culture, 1920-1940	3-5	What is productive life? How is life aesthetically and politically valued? This course explores the inscription of life in changing political and aesthetic regimes of the Andean South in the turbulent decades of the 1920s-1940s. Based on theories of biopower and soveregnity, we explore topics such as domination, domestication, appropriation, exclusion, facism, solidarity, tellurism, race, mestizaje, and human/nature relations. We will consider poetry, narrative, journals, and the visual arts. Authors include: Gabriela Mistral, Pablo Neruda, Pablo de Rokha, Alcides Arguedas, Augusto Céspedes, Franz Tamayo, Leopoldo Marechal, Roberto Artl, Jorge Luis Borges, César Vallejo, José Carlos Mariátegui, Ciro Alegría, and José María Arguedas. Spanish proficiency required.
INDE 225	Popular and Clinical Nurition: Food Facts, Fads, and Pharmacology	1	Designed for medical students and other health care professionals. Lunchtime lectures review the epidemiological and clinical research related to eating patterns and misconceptions of the public, the mechanisms of pharmacological effects of food, and related topics common to patient nutritional concerns. Topics include fad diets, the impact of dietary addiction, longevity associated with caloric restriction, toxins in foods and the action of phytonutirents. Epidemiological, clinical, and biochemical studies are reviewed in the discussion of these and other topics.
INDE 235	Wilderness Leadership and Mentorship Skills for Medical Students	1	For MD/Master of Medicine wilderness pre-orientation trip (SWEAT) leaders. Training to engage with and prepare incoming first-year medical students for the rigors of medical school. Topics include: fundamentals of wilderness survival, wilderness equipment use, wilderness first aid, camping, outdoor leadership, mentorship, team building, improvisation, risk management, cultural competency, professionalism as a physician, reflection and resiliency, first-year curriculum, stress management and coping. Guest lectures from Stanford faculty, emergency medicine physicians, National Outdoor Leadership School wilderness instructors, learning strategy specialists, and mentorship development specialists.
INTNLREL 1	Introduction to International Relations	5	Approaches to the study of conflict and cooperation in world affairs. Applications to war, terrorism, trade policy, the environment, and world poverty. Debates about the ethics of war and the global distribution of wealth.
INTNLREL 102	The History of the International System since 1914	5	After defining the characteristics of the international system at the beginning of the twentieth century, this course reviews the primary developments in its functioning in the century that followed. Topics include the major wars and peace settlements; the emergence of Nazism and Communism; the development of the Cold War and nuclear weapons; the rise of China, India, and the EU; and the impact of Islamic terrorism. The role of international institutions and international society will also be a focus as will the challenge of environment, health, poverty, and climate issues to the functioning of the system.
INTNLREL 122A	The Political Economy of the European Union	5	EU institutions, the legislative process, policies, relations with the U.S., and enlargement and the future of the EU. History and theories of EU integration. Democratic accountability of the institutions, and the emerging party system. Principal policies in agriculture, regional development, the internal market, single currency, and competition. Emphasis is on policies that affect the relations with the U.S. including trade and security. Results of the EU's constitutional convention.

IPS 203	Issues in International Economics	5	Topics in international trade and international trade policy: trade, growth and poverty, the World Trade Organization (WTO), regionalism versus multilateralism, the political economy of trade policy, trade and labor, trade and the environment, and trade policies for developing economies.
IPS 210	The Politics of International Humanitarian Action	3-5	The relationship between humanitarianism and politics in international responses to civil conflicts and forced displacement. Focus is on policy dilemmas and choices, and the consequences of action or inaction. Case studies include northern Iraq (Kurdistan), Bosnia, Rwanda, Kosovo, and Darfur.
IPS 211	The Transition from War to Peace: Peacebuilding Strategies	3-5	How to find sustainable solutions to intractable internal conflicts that lead to peace settlements. How institutions such as the UN, regional organizations, and international financial agencies attempt to support a peace process. Case studies include Bosnia, East Timor, Kosovo, Burundi, Liberia, and Afghanistan.
IPS 235	From Innovation to Implementation: How Government Can Develop and Apply New Ideas	3-5	What are the barriers to reform and innovative thinking in government? What are the factors that need to be taken into account when implementing change? What are the bureaucratic structures and power relationships that policy-makers must understand and navigate in order to embed reform? The aim of this seminar is to give students a detailed understanding of how political change happens and an understanding of why it often doesn¿t. Using cases studies from successful and unsuccessful reform programs around the world, this course will expose students to innovations in key public sector issue areas including education, healthcare, well-being, and government transparency and accountability; provides a sense of what's it's like actually trying to make change happen in a government context, and will equip students with the skills and understanding to be able to make change happen in a government setting.
LAW 245	China Law and Business	3	This introductory course provides an overview of the Chinese legal system and business environment and examines Chinese legal rules and principles in selected business-related areas. These areas include intellectual property, dispute resolution, foreign investment, mergers and acquisitions, antimonopoly law, and environment. Through active class participation and analysis of business case studies, students will learn both the law in the books and the law in action in China, as well as strategies that businesses could use to overcome limitations in the Chinese legal system. Leaders from the legal and business communities will be invited to share their experiences and insights.

LAW 280	Toxic Harms	3	This seminar will examine the concerns arising from exposure to toxic substances from a variety of perspectives. A principal focus will be tort liability, and a central theme in the course will be whether tort law is an effective method of compensating victims of toxic exposure and controlling the distribution and/or emission of toxic substances. In order to assess the efficacy of tort, it is essential to compare the liability system with alternatives such as restructured "public law" litigation, administrative compensation schemes, and regulatory control strategies. Moreover, it seems equally important that these options be grounded in a concrete understanding of the major current problem areas. To accomplish these aims, the course will focus on a number of specific present concerns, including tobacco, asbestos, anti-inflammatory drugs, and natural gas extraction (fracking). In each instance, we will look at the nature of the public health problem as well as ensuing tort litigation and regulatory activity. In addition to examining these distinctive problem areas, we will look at broader, cross-cutting institutional reform proposals that have received recent attention.
LAW 281	Natural Resources Law and Policy	3	Natural resource management presents extremely difficult and contentious issues of law and public policy. Major debates continue to rage over issues such as the Endangered Species Act, whether the United States should permit drilling in the Arctic National Wildlife Refuge, and how to prevent the overfishing of the oceans. This course will focus on two major aspects of natural-resource management: biodiversity protection (including the Endangered Species Act, ocean fisheries management, and global protection of marine mammals) and public lands in the United States such as national parks and wilderness areas. The course also will examine the National Environmental Protection Act and the effectiveness of environmental impact assessments. Class sessions will include critical examinations of current law and policy and in-depth discussions of situational case studies that force you to consider how you would resolve real-life issues.
LAW 432	Natural Resources Law and Policy Workshop	2-3	This workshop seminar will provide students with the opportunity to examine and critique cutting-edge research and work in the field of environment, energy, and natural resources. Although it is open to all students, the seminar is designed especially for those with an interest in the field who wish to stay abreast of current issues, work, and ideas. In each class, an academic expert, policy maker, or practitioner will present their current research or work and engage in a robust discussion.

LAW 455	Energy Law	3	The supply of a reliable, low-cost, clean energy supply for the United States is a key determinant of current and future prosperity. Perhaps as a result, electricity suppliers are among the most heavily regulated of large firms. In this course, students will acquire a basic understanding of the electricity supply system, of rate based regulation of electric utilities, and of deregulated wholesale electricity markets. We will also interrogate the role of siting and cost recovery in development of a workable transmission grid. The course will then focus on various attempts at reform of both rate-regulated and wholesale market-based structures. In particular, we will examine various attempts to strengthen incentives for utility investment in energy efficiency. Finally, students will be familiarized with various approaches to subsidization of renewable energy.nnThroughout, the course will focus on the sometime cooperative, sometimes competing, but ever evolving federal and state roles in regulating the supply of electricity.
LAW 458	Food and Drug Administration	3	This course will examine the Food and Drug Administration. It will focus largely on the FDA's regulation of drugs and biologics, but will also cover its regulation of medical devices, nutritional supplements, and, to some extent, its jurisdiction over food, legal, social, and ethical issues arising from advances in the biosciences. The class is open to all law or medical students. Graduate students may be admitted from other parts of the University by consent of the instructor. Substantial class attendance is required; in addition, the quality of class participation will play a small role in grading.
LAW 603	Environmental Law and Policy	3	This course serves as an introduction to federal environmental law, regulation, and policy in the United States. The course begins with a discussion of the property law roots of environmental law and the risk assessments and regulatory frameworks essential to understanding the current US approach to environmental problems. Next, the course focuses on federal statutes including the Toxic Substances Control Act, the Clean Air Act, the Clean Water Act, the Endangered Species Act, and the National Environmental Policy Act. The course concludes with a discussion of current EPA efforts to address emissions of greenhouse gases.
LAW 622A	Environmental Law Clinic: Clinical Practice	4	Students enrolled in the Clinic provide legal assistance to national, regional and grassroots non-profit organizations on a variety of environmental issues, with a focus on complex natural resource conservation and biodiversity matters at the interface of law, science and policy. Working under the direct supervision of practicing environmental attorneys, Clinic students help screen new matters and potential clients; formulate strategies; research and develop factual and legal issues; and prosecute administrative and litigation proceedings. During the term, students may meet with clients, opposing counsel or agency decision makers; review administrative records; develop expert testimony; draft comment letters, petitions, pleading or briefs; and/or attend and participate in administrative and court hearings. In regular one-on-one meetings with supervising faculty, there is a heavy emphasis on polishing persuasive writing and oral advocacy skills. In addition, students participate in a weekly seminar where we examine strategic, ethical and substantive issues arising out of the Clinic's work. No prior substantive experience or background in the environmental/natural resource field is necessary, but an interest in learning about these areas of the law is important.

LAW 622B	Environmental Law Clinic: Clinical Methods	4	Students enrolled in the Clinic provide legal assistance to national, regional and grassroots non-profit organizations on a variety of environmental issues, with a focus on complex natural resource conservation and biodiversity matters at the interface of law, science and policy. Working under the direct supervision of practicing environmental attorneys, Clinic students help screen new matters and potential clients; formulate strategies; research and develop factual and legal issues; and prosecute administrative and litigation proceedings. During the term, students may meet with clients, opposing counsel or agency decision makers; review administrative records; develop expert testimony; draft comment letters, petitions, pleading or briefs; and/or attend and participate in administrative and court hearings. In regular one-on-one meetings with supervising faculty, there is a heavy emphasis on polishing persuasive writing and oral advocacy skills. In addition, students participate in a weekly seminar where we examine strategic, ethical and substantive issues arising out of the Clinic's work. No prior substantive experience or background in the environmental/natural resource field is necessary, but an interest in learning about these areas of the law is important.
LAW 622C	Environmental Law Clinic: Clinical Coursework	4	Students enrolled in the Clinic provide legal assistance to national, regional and grassroots non-profit organizations on a variety of environmental issues, with a focus on complex natural resource conservation and biodiversity matters at the interface of law, science and policy. Working under the direct supervision of practicing environmental attorneys, Clinic students help screen new matters and potential clients; formulate strategies; research and develop factual and legal issues; and prosecute administrative and litigation proceedings. During the term, students may meet with clients, opposing counsel or agency decision makers; review administrative records; develop expert testimony; draft comment letters, petitions, pleading or briefs; and/or attend and participate in administrative and court hearings. In regular one-on-one meetings with supervising faculty, there is a heavy emphasis on polishing persuasive writing and oral advocacy skills. In addition, students participate in a weekly seminar where we examine strategic, ethical and substantive issues arising out of the Clinic's work. No prior substantive experience or background in the environmental/natural resource field is necessary, but an interest in learning about these areas of the law is important.

LAW 622D	Environmental Law Clinic: Clinical Practice	3-4	This section of the Clinic is open only to Law students who are also pursing graduate degrees in schools other than the School of Law. Students enrolled in the Clinic provide legal assistance to national, regional and grassroots non-profit organizations on a variety of environmental issues, with a focus on complex natural resource conservation and biodiversity matters at the interface of law, science and policy. Working under the direct supervision of practicing environmental attorneys, Clinic students help screen new matters and potential clients; formulate strategies; research and develop factual and legal issues; and prosecute administrative and litigation proceedings. During the term, students may meet with clients, opposing counsel or agency decision makers; review administrative records; develop expert testimony; draft comment letters, petitions, pleading or briefs; and/or attend and participate in administrative and court hearings. In regular one-on-one meetings with supervising faculty, there is a heavy emphasis on polishing persuasive writing and oral advocacy skills. In addition, students participate in a weekly seminar where we examine strategic, ethical and substantive issues arising out of the Clinic's work.
LAW 622E	Environmental Law Clinic: Clinical Methods	3-4	This section of the Clinic is open only to Law students who are also pursing graduate degrees in schools other than the School of Law. Students enrolled in the Clinic provide legal assistance to national, regional and grassroots non-profit organizations on a variety of environmental issues, with a focus on complex natural resource conservation and biodiversity matters at the interface of law, science and policy. Working under the direct supervision of practicing environmental attorneys, Clinic students help screen new matters and potential clients; formulate strategies; research and develop factual and legal issues; and prosecute administrative and litigation proceedings. During the term, students may meet with clients, opposing counsel or agency decision makers; review administrative records; develop expert testimony; draft comment letters, petitions, pleading or briefs; and/or attend and participate in administrative and court hearings. In regular one-on-one meetings with supervising faculty, there is a heavy emphasis on polishing persuasive writing and oral advocacy skills. In addition, students participate in a weekly seminar where we examine strategic, ethical and substantive issues arising out of the Clinic's work.

LAW 622F	Environmental Law Clinic: Clinical Coursework	3-4	This section of the Clinic is open only to Law students who are also pursing graduate degrees in schools other than the School of Law. Students enrolled in the Clinic provide legal assistance to national, regional and grassroots non-profit organizations on a variety of environmental issues, with a focus on complex natural resource conservation and biodiversity matters at the interface of law, science and policy. Working under the direct supervision of practicing environmental attorneys, Clinic students help screen new matters and potential clients; formulate strategies; research and develop factual and legal issues; and prosecute administrative and litigation proceedings. During the term, students may meet with clients, opposing counsel or agency decision makers; review administrative records; develop expert testimony; draft comment letters, petitions, pleading or briefs; and/or attend and participate in administrative and court hearings. In regular one-on-one meetings with supervising faculty, there is a heavy emphasis on polishing persuasive writing and oral advocacy skills. In addition, students participate in a weekly seminar where we examine strategic, ethical and substantive issues arising out of the Clinic's work.
LAW 650	Advanced Neogitation: Public Policy	3	Complex and multi-party negotiations permeate law practice and life. Advanced Negotiation is designed to take students beyond the two-party, lawyer-client negotiations that were the focus of the Negotiation Seminar, to examine many facets of negotiation complexity, both in terms of the participants and topics. This section of Advanced Negotiation focuses on more complex negotiations as well as multi-party negotiations, working in teams, and negotiating on behalf of complex organizations on diverse environmental policy issues, including: environment and health issues. The goals of the class are twofold, for students (1) to acquire an added theoretical base beyond what was covered in the Negotiation Seminar through which to analyze and prepare for negotiations, and (2) to expand their skills through deeper examination of various actual negotiation cases and complex simulations.

LAW 661	Advanced Negotiation: International	3	Building on skills developed, tools acquired and theory learned in the Gould Center's basic negotiation course, this advanced seminar explores how lawyers, diplomats, NGOs and citizen advocates can successfully negotiate bilateral agreements and multilateral agreements in the international field. We will study the unique process dynamics of international treaty-making, cross-border agreement negotiations, and multi-party consensus building processes. We will explore the role of power, culture, agency, and strategy in international negotiation, and we will analyze the design and conduct of effective "negotiation campaigns." We will examine negotiation processes in the context of geopolitical relations, nuclear arms control, US-Mexico border management, environmental regimes, foreign investment, natural resource development, human rights, commercial disputes, and corporate social responsibility. Our approach will involve analysis of in-depth case studies and participation in complex role-playing exercises (including at one intensive simulation to be negotiated out of class over several weeks). These cases and exercises involve negotiations between state parties as well as negotiations , although our study will also include some attention to negotiations involving non-state actors, including business corporations, NGOs, and indigenous communities. A number of class sessions will include interaction with guest participants including international lawyers, scholarly experts, diplomats, senior corporate officers and NGO leaders.

LAW 678	Introduction to Microeconomics	3	It is no secret that economic ideas are being usednnincreasingly in law school courses, in law practice, and in a wide variety of other fields that a law school graduate might choose to pursue - antitrust, corporate, environmental, tax, labor, and securities are just some of the immediate examples that come to mind. While many Stanford Law School students have already taken courses in economics as undergraduates, or might even have majored in economics, many of you have not. This course is offered to "bring you up to speed" so that you will not be at a disadvantage in other courses at the Law School that draw on economic ideas (or, just as importantly, not be at a disadvantage when you graduate and you encounter economic ideas and arguments on the job or in life. So, what is economics, exactly? All societies face the problem of scarcity - there are not enough resources to satisfy people's desires for all things. Economics studies how individuals and societies deal with scarcity and the mechanisms for deciding what to produce, how to produce it, and who gets the output. It is as simple and complex as that! As you can imagine, the practical applications are nearly endless. Please note that the course focus will be microeconomics - the branch of economics that focuses on the economic behavior of individual decision-making units, such as households and firms, and how these individual decisions fit together. (I will not discuss macroeconomics in this course - i.e. the behavior of the economy as a whole, particularly inflation, unemployment, and business cycles). More specifically, I will spend the vast majority of the course taking you through the basic supply and demand model of markets - what it is, where it came from, how and when it works, and when it does not work so well. With that base, I can branch out accordingly to help you apply it to a wide variety of relevant issues. Though I will not focus specifically on how economic ideas have been used in a legal context (there is another course and seminar that does that), I will make some effort to link the economic ideas we discuss directly to legal topics. Primary goal is to teach you the fundamental principles of microeconomics by (1) providing you the relevant schema to understand the basic tools of economic analysis; and by (2) drilling you extensively with problems, cases, current events, and other applied materials so as to help you develop the ability to use these tools and truly make them your own. A heavy emphasis will be placed on building a conceptual understanding of some key economic models, looking closely at the underlying assumptions of those models, and engaging in the process of questioning and relaxing those assumptions in the context of actual "real life" issues.
MATSCI 152	Electronic Materials Engineering	4	Materials science and engineering for electronic device applications. Kinetic molecular theory and thermally activated processes; band structure and electrical conductivity of metals and semiconductors; intrinsic and extrinsic semiconductors; diffusion; elementary p-n junction theory; operating principles of metal-oxide-semiconductor field effect transistors. Semiconductor processing including crystal growth, oxidation kinetics, ion implantation, thin film deposition, etching, and photolithography.
MATSCI 154	Thermodynamics of Energy Conversions at the Nanoscale	4	The principles of thermodynamics applied to the conversion of energy between light, heat, electricity, and chemical bonds. Modifications to thermodynamic phenomena, such as phase equilibria, when the material dimension approaches the nanometer length scale.

MATSCI 164	Electronic and Photonic Materials and Devices Laboratory	4	Lab course. Current electronic and photonic materials and devices. Device physics and micro-fabrication techniques. Students design, fabricate, and perform physical characterization on the devices they have fabricated. Established techniques and materials such as photolithography, metal evaporation, and Si technology; and novel ones such as soft lithography and organic semiconductors.
MATSCI 256	Solar Cells, Fuel Cells, and Batteries: Materials for the Energy Solution	3-4	Operating principles and applications of emerging technological solutions to the energy demands of the world. The scale of global energy usage and requirements for possible solutions. Basic physics and chemistry of solar cells, fuel cells, and batteries. Performance issues, including economics, from the ideal device to the installed system. The promise of materials research for providing next generation solutions.
MATSCI 302	Solar Cells	3	Theory of conventional pn junction and excitonic solar cells. Design, fabrication and characterization of crystalline silicon, CdTe, CIGS, tandem and organic solar cells. The device simulator PC1D is used to predict the performance of solar cells with various designs, recombination lifetime and surface recombination rates. The materials science aspects of solar cells research is emphasized, but module design and economic hurdles that must be overcome for solar cell technology to generate a significant fraction of the world's electricity are also addressed.
MATSCI 343	Organic Semiconductors for Electronics and Photonics	3	The science of organic semiconductors and their use in electronic and photonic devices. Topics: methods for fabricating thin films and devices; relationship between chemical structure and molecular packing on properties such as band gap, charge carrier mobility and luminescence efficiency; doping; field-effect transistors; light-emitting diodes; lasers; biosensors; photodetectors and photovoltaic cells.
ME 131B	Fluid Mechanics: Compressible Flow and Turbomachinery	4	Engineering applications involving compressible flow: aircraft and rocket propulsion, power generation; application of mass, momentum, energy and entropy balance to compressible flows; variable area isentropic flow, normal shock waves, adiabatic flow with friction, flow with heat addition. Operation of flow systems: the propulsion system. Turbomachinery: pumps, compressors, turbines. Angular momentum analysis of turbomachine performance, centrifugal and axial flow machines, effect of blade geometry, dimensionless performance of turbomachines; hydraulic turbines; steam turbines; wind turbines. Compressible flow turbomachinery: the aircraft engine.
ME 140	Advanced Thermal Systems	5	Capstone course. Thermal analysis and engineering emphasizing integrating heat transfer, fluid mechanics, and thermodynamics into a unified approach to treating complex systems. Mixtures, humidity, chemical and phase equilibrium, and availability. Labs apply principles through hands-on experience with a turbojet engine, PEM fuel cell, and hybrid solid/oxygen rocket motor. Use of MATLAB as a computational tool.
ME 14N	How Stuff is Made	3	The design and engineering of products and processes, such as machining, fabric, food, and electrical goods. Tradeoffs in choice of materials, features, and process selection. Final project: students research and redesign the engineering and manufacturing aspects of a product and its processes with an eye toward sustainability. Includes several field trips to manufacturing facilities.

ME 185	Electric Vehicle Design	3	This project based class focuses on the design and prototyping of electric vehicles. Students learn the fundamentals of vehicle design in class and apply the knowledge as they form teams and work on projects involving concept, specifications, structure, systems, integration, assembly, testing, etc. The class meets once a week to learn about the fundamentals, exchange their experiences, and coordinate between projects. The teams of 3-5 will work on their projects independently.
ME 206A	Entrepreneurial Design for Extreme Affordability	4	Project course jointly offered by School of Engineering and Graduate School of Business. Students apply engineering and business skills to design product prototypes, distribution systems, and business plans for entrepreneurial ventures in developing countries for a specified challenge faced by the world's poor. Topics include user empathy, appropriate technology design, rapid prototype engineering and testing, social technology entrepreneurship, business modeling, and project management. Weekly design reviews; final course presentation. Industry and adviser interaction.
ME 206B	Entrepreneurial Design for Extreme Affordability	4	Part two of two-quarter project course jointly offered by School of Engineering and Graduate School of Business. Second quarter emphasizes prototyping and implementation of specific projects identified in first quarter. Students work in cross-disciplinary project teams. Industry and adviser interaction, weekly design reviews; final course presentation.
ME 214	Good Products, Bad Products	3-4	The characteristics of industrial products that cause them to be successes or failures: the straightforward (performance, economy, reliability), the complicated (human and cultural fit, compatibility with the environment, craftsmanship, positive emotional response of the user), the esoteric (elegance, sophistication, symbolism). Engineers and business people must better understand these factors to produce more successful products. Projects, papers, guest speakers, field trips.
ME 216A	Advanced Product Design: Needfinding	3-4	Human needs that lead to the conceptualization of future products, environments, systems, and services. Field work in public and private settings; appraisal of personal values; readings on social ethnographic issues; and needfinding for a corporate client. Emphasis is on developing the flexible thinking skills that enable the designer to navigate the future.

ME 223	Innovating Water Solutions for Developing Countries	2-3	Primarily for graduate students and seniors with strong design and mechanical engineering backgrounds. Currently 1.1 billion people lack safe drinking water and 2.6 billion people lack adequate sanitation. The FAO states that by 2025 1.9 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under stress conditions. The Stanford ChangeLabs has initiated a project called the 100 Liter Water project, designed to form strategies to deliver a minimum of 100 liters of water per day per family to the poorest communities in the world. This is a self-directed project class restricted to 15 students selected through an application process. Students work individually and in teams on water related technologies such as solar based low flow pumping systems, rainwater catchment systems, and storage systems. The studio class entails working on the design of solar powered low flow pumps, rainwater catchment systems, and very low cost storage systems designed for sparsely distributed communities in water stressed regions of the world. Students expected to work with autonomy and self-direction, going through multiple rounds of prototyping to generate breakthrough technologies designed to make deep impact.
ME 250	Internal Combustion Engines	1-5	Internal combustion engines including conventional and turbocharged spark ignition, and diesel engines. Lectures: basic engine cycles, engine components, methods of analysis of engine performance, pollutant emissions, and methods of engine testing. Lab involves hands-on experience with engines and test hardware.
ME 257	Turbine and Internal Combustion Engines	3	Principles of design analysis for aircraft gas turbines and automotive piston engines. Analysis for aircraft engines performed for Airbus A380 type aircraft. Design parameters determined considering aircraft aerodynamics, gas turbine thermodynamics, compressible flow physics, and material limitations. Additional topics include characteristics of main engine components, off-design analysis, and component matching. Performance of automotive piston engines including novel engine concepts in terms of engine thermodynamics, intake and exhaust flows, and in-cylinder flow.
ME 25N	Energy Sustainability and Climate Change	3	One of the primary global challenges of the 21st century is providing the energy required to meet increasing demands due to population growth and economic development. A related challenge is mitigation of the effect of this energy growth on climate. This seminar will examine various scenarios for the energy resources required to meet future demand and the potential consequences on climate. The scientific issues underlying climate change and the coupling of energy use with changes in the global atmosphere that impact climate will be discussed.
ME 260	Fuel Cell Science and Technology	3	Emphasis on proton exchange membrane (PEM) and solid oxide fuel cells (SOFC), and principles of electrochemical energy conversion. Topics in materials science, thermodynamics, and fluid mechanics.

ME 302	The Future of the Automobile	1	This quarter, the seminar will take a specific focus on "Vehicle Communication Systems," which connect vehicles to the outside world and with one another. Respective concepts include online media and services in the vehicle, vehicles communicating with a centralized traffic management infrastructure, and vehicles communicating among themselves to avoid collisions and improve traffic flow. This class consists in the first half of lectures by an industry expert and in the second half of group work when students will develop scenarios for vehicle communication systems. The goal of the course is to develop a technical understanding as well as an understanding for the interactions of technology, business, and society with a specific automotive focus and assess technology in a larger context.
ME 370A	Energy Systems I: Thermodynamics	3	Thermodynamic analysis of energy systems emphasizing systematic methodology for and application of basic principles to generate quantitative understanding. Availability, mixtures, reacting systems, phase equilibrium, chemical availability, and modern computational methods for analysis. Prerequisites: undergraduate engineering thermodynamics and computer skills such as Matlab.
ME 370B	Energy Systems II: Modeling and Advanced Concepts	4	Development of quantitative device models for complex energy systems, including fuel cells, reformers, combustion engines, and electrolyzers, using thermodynamic and transport analysis. Student groups work on energy systems to develop conceptual understanding, and high-level, quantitative and refined models. Advanced topics in thermodynamics and special topics associated with devices under study.
MED 108Q	Human Rights and Health	3	Preference to sophomores. History of human-rights law. International conventions and treaties on human rights as background for social and political changes that could improve the health of groups and individuals. Topics such as: regional conflict and health, the health status of refugees and internally displaced persons; child labor; trafficking in women and children; HIV/AIDS; torture; poverty, the environment and health; access to clean water; domestic violence and sexual assault; and international availability of drugs. Possible optional opportunities to observe at community sites where human rights and health are issues. Guest speakers from national and international NGOs including Doctors Without Borders; McMaster University Institute for Peace Studies; UC Berkeley Human Rights Center; Kiva. PowerPoint presentation on topic of choice required.
MED 157	Foundations for Community Health Engagement	3	Open to undergraduate, graduate, and MD students. Examination and exploration of community health principles and their application at the local level. Designed to prepare students to make substantive contributions in a variety of community health settings (e.g. clinics, government agencies, non-profit organization, advocacy groups). Topics include community health assessment; health disparities; health promotion and disease prevention; strategies for working with diverse, low-income, and underserved populations; and principles of ethical and effective community engagement.

MED 1A	Leadership in Multicultural Health	2	Designed for undergraduates serving as staff for the Stanford Medical Youth Science Summer Residential Program (SRP). Structured opportunitie to learn, observe, participate in, and evaluate leadership development, multicultural health theories and practices, and social advocacy. Utilizes service learning as a pedagogical approach to developing an understanding of the intersections between identity, power and privilege and disparities (health, education, environment), fostering knowledge and skills to become social advocates to address forms of inequities. Students explore approaches for identifying and tackling issues of equity (health and education) as well as learn fundamental skills necessary to implement activities for the Summer Residential Program.
MED 1B	Identity, Power, and Privilege in Multicultural Health	1	An independent study service learning course designed to develop students' understanding of the intersection between identity, power, privilege, and disparities (health, education, environment). Students submit a written reflective term paper based on their experience as staff for the Summer Residential Program as well as their understanding of how constructs of identity, power and privilege impact low-income and underrepresented students in their pursuit of higher education.
MED 228	Physicians and Social Responsibility	1	Social and political context of the roles of physicians and health professionals in social change; policy, advocacy, and shaping public attitudes. How physicians have influenced governmental policy on nuclear arms proliferation; environmental health concerns; physicians in government; activism through research; the effects of poverty on health; homelessness; and gun violence. Guest speakers from national and international NGOs.
MED 229	Introduction to Global Health	1	Provides an overview of global health and how it is similar to and different from public health and tropical medicine. Topics include the evolution, economics, politics of global health, major players in global health, and issues of geography, politics, humanitarianism, human rights, science, research, culture and disease.
MED 232	Discussions in Global Health	2	The goal of this interactive series is to encourage students to think broadly about the variety of activities encompassed within global health and the roles of various entities, including NGOs, governments, and healthcare providers, in responding to large-scale health crises, building health systems, and caring for patients in developing countries. Examines challenges in global health such as organizing medical responses to natural disasters, providing healthcare to societies in conflict, and integrating traditional and modern approaches to healing. Case studies are used to critique strategies employed by organizations that work to improve medical care in poor settings.
MGTECON 331	Political Economy of Health Care in the United States	3	This course provides the legal, instititional, and economic background necessary to understand the financing and production of health services in the US. Potential topics include: health reform, health insurance (Medicare and Medicaid, employer-sponsored insurance, the uninsured), medical malpractice and quality regulation, pharmaceuticals, the corporate practice of medicine, regulation of fraud and abuse, and international comparisons.

MGTECON 651	Natural Resource and Energy Economics	4	Management and provision non-renewable and renewable natural resources, with considerable attention to energy provision and use. Topics include: fisheries problems and policy; energy industry market structure, pricing, and performance; and policies to facilitate transitions from non-renewable to renewable energy.
MI 70Q	Photographing Nature	3	Utilizes the idiom of photography to learn about nature, enhance observation, and explore scientific concepts. Builds upon the pioneering photographic work of Eadweard J. Muybridge on human and animal locomotion. A secondary goal is to learn the grammar, syntax, composition, and style of nature photography to enhance the use of this medium as a form of scientific communication and also to explore the themes of change across time and space. Scientific themes to be explored include: taxonomy, habitat preservation, climate change; species diversity; survival and reproductive strategies; ecological niches and coevolution, carrying capacity and sustainability, population densities, predation, and predator-prey relationships, open-space management, the physics of photography. Extensive use of field trips and class critque.
MSE 190	Methods and Models for Policy and Strategy Analysis	3	Guest lectures by departmental practitioners. Emphasis is on links among theory, application, and observation. Environmental, national security, and health policy; marketing, new technology, and new business strategy analyses. Comparisons between domains and methods.
MSE 243	Energy and Environmental Policy Analysis	3	Concepts, methods, and applications. Energy/environmental policy issues such as automobile fuel economy regulation, global climate change, research and development policy, and environmental benefit assessment. Group project.
MSE 264	Sustainable Product Development and Manufacturing	3-4	Strategies and techniques for development of sustainable products and manufacturing processes. Topics: strategic decisions in new product development when environmental and resource externalities are accounted for; effect of regulatory requirements on ability of a firm to achieve its business objectives; contributions of sustainable products/processes to the firm's competitive advantage and operational efficiency and to enabling entrepreneurial opportunities; industrial ecology and life cycle analysis techniques in integrating traditional product development requirements with those of the environment and society.
MSE 289	Designing for Sustainable Abundance	3-4	Hands-on, team-based, multidisciplinary class, uses radically human-centered approach to tackle sustainability challenges in areas like food and transportation. Teams develop solutions that improve environmental and economic sustainability as well as physical and emotional well-being. Students benefit from close interaction with the teaching team, support from project sponsors, and the varied perspectives of numerous guest speakers.
MSE 295	Energy Policy Analysis	3	Design and application of formal analytical methods for policy and technology assessments of energy efficiency and renewable energy options. Emphasis is on integrated use of modeling tools from diverse methodologies and requirements for policy and corporate strategy development.

MSE 299	Voluntary Social Systems	1-3	Ethical theory, feasibility, and desirability of a social order in which coercion by individuals and government is minimized and people pursue ends on a voluntary basis. Topics: efficacy and ethics; use rights for property; contracts and torts; spontaneous order and free markets; crime and punishment based on restitution; guardian-ward theory for dealing with incompetents; the effects of state action-hypothesis of reverse results; applications to help the needy, armed intervention, victimless crimes, and environmental protection; transition strategies to a voluntary society.
MSE 446	Policy and Economic Research Roundtable	1	Research in progress or contemplated in policy and economics areas. Emphasis depends on research interests of participants, but is likely to include energy, environment, transportation, or technology policy and analysis.
MSE 92Q	International Environmental Policy	3	Preference to sophomores. Science, economics, and politics of international environmental policy. Current negotiations on global climate change, including actors and potential solutions. Sources include briefing materials used in international negotiations and the U.S. Congress.
NATIVEAM 109A	Federal Indian Law	5	Cases, legislation, comparative justice models, and historical and cultural material. The interlocking relationships of tribal, federal, and state governments. Emphasis is on economic development, religious freedom, and environmental justice issues in Indian country.
OBGYN 256	Current Controversies in Women's Health	2-3	Interdisciplinary. Focus is on the U.S. Topics include: health research; bioethical, legal, and policy issues; scientific and cultural perspectives; social influences; environmental and lifestyle effects on health; and issues related to special populations. Guest lecturers; student debates.
OIT 258	Incentive Mechanisms for Societal Networks	2	In many of the challenges faced by the modern world, from overcrowded road networks to overstretched healthcare systems, large benefits for society come about from small changes by very many individuals. This course survey the problems and the cost they impose on society. It describes a series of pilot projects which aim to develop principles for inducing small changes in behavior in Societal Networks--transportation networks, wellness programs, recycling systems and, if time permits, energy grids. Students will learn how low-cost sensing and networking technology can be used for sensing individual behavior, and how incentives and social norming can be used to influence the behavior. The effectiveness of this approach in pilots conducted in Bangalore (commuting), Singapore (public transit system), Stanford (congestion and parking), and a wellness program at Accenture-USA will be discussed. Students may experience the incentive platform as participants.

OIT 538	Environmental Science for Managers - Accelerated	3	This course satisfies the MBA distribution requirement in Optimization and Simulation Modeling (OSM). It is challenging but doable for students without an undergraduate degree in science or engineering; it does not assume experience in environmental science or quantitative analysis beyond admission requirements for the MBA program. Students will learn fundamental science of ecosystems, climate and energy systems, by building decision-support models for managing these systems. In so doing, students will develop widely-applicable skills in model representation in a spreadsheet, optimization, and Monte Carlo simulation. nnnStudents are strongly encouraged to take the follow-on course on renewable energy, OIT 540 Environmental Science for Managers II.
OIT 539	Environmental Science for Managers - Advanced	3	Fundamental science of ecosystems, climate and energy. Spreadsheet modeling, optimization, and Monte Carlo simulation applied to resource management and environmental policy. Similar to OIT 338, but allocates more class time to environmental/energy science and implications for management and policy, and less class time to fundamentals of modeling/optimization/simulation.
OIT 540	Environmental Science for Managers II	1	This course provides an introduction to renewable sources of electricity and fuel, and is required for the joint MBA-MS in Environment and Resources degree. Students are strongly encouraged, but not required, to take OIT 538 or OIT 539 prior to taking this course.
OSPAUSTL 10	Coral Reef Ecosystems	3	Key organisms and processes, and the complexity of coral reef ecosystems. Students explore the Great Barrier Reef from the southern end which demonstrates the physical factors that limit coral reefs, to the northern reef systems which demonstrate key aspects of these high biodiversity ecosystems. Human-related changes. Emphasis is on research experiences and development of analytical skills.
OSPAUSTL 25	Freshwater Systems	3	Integrated water resource management and how this applies across the globe, comparing strategies and results in the developing and more developing world. Ethics, values and politics of water and the management of extremes such as drought and flood. Ecology and hydrology in an urban context, along with important current issues such as stormwater and water sensitive urban design. Construction of a well, a water tank, and a pit latrine. Community service working with a local catchment management group on riparian and wetland restoration work. Field work complements lectures.
OSPAUSTL 30	Coastal Forest Ecosystems	3	Prehistory of Australian rainforest and how rainforest structure and biodiversity change with altitude, latitude, and geology. Tropical coastal marine wetlands, mangrove forests, and the relationship between land- and sea-based biota. Biology and ecology of marine plants, mangroves, and tropical salt marsh. Introduction to specialized fields of marine plant biology and ecology including biogeography and evolution, aquatic plant ecophysiology, water quality and bioindicator techniques, pollution and eutrophication, and environmental control of marine plant distribution and productivity.
OSPAUSTL 40	Australian Studies	3	Introduction to Australian society, history, culture, politics, and identity. Social and cultural framework and working understanding of Australia in relationship to the focus on coastal environment in other program courses. Field trips.

OSPBER 48	Topics in Medicine and Ethics	2-4	Independent study with weekly meetings. Topics: comparative analysis of legislation of human fertilization and embryology in the U.S. and UK; history and structure of the health care systems in Germany, Canada, and the U.S.; lives of admirable precepts but dubious practice such as Seneca, the Stoics, and Rousseau; promise and pitfalls of genetically modified plant and animal food. Do ethnic, national, and professional stereotypes serve a function? Primarily in English, but some topics might require German.
OSPCPTWN 45	Energy and Africa	5	How development in Africa will impact global energy choices in the second half of this century. Role that energy plays in fostering (or inhibiting) development. Key questions: How does development affect possible choices about energy? How do energy resources and their mobilization affect local people? How does the global economics of energy exert pressure on governments in the developing world? How does education affect population and indigenous efforts to develop local solutions to problems? How do these affect projections for global energy in the future?
OSPMOSC 74	Post-Soviet Eurasia and SCO: Society, Politics, Integration	5	Analysis of the opportunities and challenges for political, economic, and military cooperation within the Shanghai Cooperation Organization (SCO). Likelihood of SCO's aspirations being realized and the potential of its becoming a political and military counterbalance to the West. Issues related to national security and security perceptions of post-Soviet states and China, their economic and energy ambitions and needs, and the role of external players in the region.
OSPOXFRD 18	Making Public Policy: An Introduction to Political Philosophy, Politics, and Economics	4-5	UK and U.S. What should society look like? How should incomes be distributed? How should it be taxed? How much inequality is acceptable? The overlap of economics with practical politics through political philosophy behind the government decisions; how public policy ought to be formulated. Issues include poverty, environmental policy, trade and globalization, and transport.
OSPOXFRD 56	Global Trends and National Decisions	4-5	Trends and drivers that will shape events, and constrain or expand opportunities for selected countries or regions during the period between 2012 and 2025. Trends and drivers to be examined include demography; climate change; competition for energy, water, and other resources; globalization; the rise of China, India, and others; nuclear power and nuclear proliferation; growing wealth and growing inequality; and decreasing capabilities of governments to manage developments inside (and across) their administrative boundaries. Analysis informed by studies in the National Intelligence Council's Global Trends series, prepared by the non-partisan Foreign Policy Association for its Great Decisions series.
OSPSANTG 58	Living Chile: A Land of Extremes	5	Physical, ecological, and human geography of Chile. Perceptions of the Chilean territory and technologies of study. Flora, fauna, and human adaptations to regional environments. Guest lectures; field trips; workshops.
OSPSANTG 76	Ecology and Biodiversity of Latin America	4	Significance of the biodiversity of Latin America at the global level for both scientists and society at large. How biodiversity represents natural capital, important for human wellbeing. Challenges to natural capital in the face of current global environmental changes. Field trips to two conservation areas in Chile to understand conservation efforts and challenges.

OSPSANTG 85	Marine Ecology of Chile and the South Pacific	5	Relationships among physical processes in the ocean, biological productivity, and the exploitation of resources by high-thropic-level predators including human beings. Characterization of ecological patterns; identification of processes operating on marine systems. Open ocean ecosystems, intertidal and benthic regions of the world's oceans, and ecological research developed along coastal regions, focusing on Chile's 4,000 km coastline.
PEDS 150	Social and Environmental Determinants of Health	3	How race/ethnicity and SES contribute to health disparities, how vulnerable populations are uniquely at health risk, and how the built environment relates to health and wellness. Topics include: gender, age, race/ethnicity, language, education, individual SES and neighborhood SES as related to health; individual and structural race bias; health needs of vulnerable populations (e.g., the homeless, the incarcerated, immigrant populations, children, and uninsured/underinsured); and environmental forces (e.g., urban design/planning, traffic/car culture, green space, housing, food access/culture, law enforcement, and media).
PEDS 223	Human Rights and Global Health	3	Open to medical students, graduate students, and advanced undergraduates. Examines the newly emerging field of human rights and global health, beginning with the essential background into the field of human rights, and the recent emergence of health as a human right. Emphasis is on the pioneering work of Dr. Paul Farmer and Partners in Health and the challenge he and his organization have posed to the conventional wisdom about approaches to combating poor health and disease worldwide. Topics include the "big three" infectious diseases -- tuberculosis, malaria, and HIV/AIDS -- as well as emerging infectious diseases, clean water and sanitation, and malnutrition and famine.
PEDS 225	Humanitarian Aid and Politics	3	Open to medical students, graduate students, and undergraduate students. Examines the moral dilemmas and political realities that complicate the delivery of humanitarian aid, especially when undertaken by the United Nations and non-governmental organizations (NGOs). Emphasis is on what humanitarians call "complex humanitarian emergencies": crises often characterized by famine and/or epidemic disease and typically the result of war and/or civil war. Provides background into the history of humanitarian aid, though focus is on the post-Cold War era, up to the recent crises in Libya and Syria.
PHIL 25SI	The Animal-Human Relationship: Interdisciplinary Perspectives	1	The ethical, scientific, and spiritual problems that arise from the interaction between humans and other animals. Can animals have empathy? What does it mean for an animal to feel pain? How did humans come to dominate other animals? What moral obligations do humans have towards animals? Where do animals fit in religious thought? Is animal research ethical, and is it effective? What role does meat consumption play in modern society? How can the environmental impacts of livestock production be mitigated? Guest lecturers from philosophy, literature, biology, neurology, religious studies, psychology, anthropology, and environmental science.
PHIL 274A	Moral Limits to the Market	4	Morally controversial uses of markets and market reasoning in areas such as organ sales, procreation, education, and child labor. Would a market for organ donation make saving lives more efficient; if it did, would it thereby be justified? Should a nation be permitted to buy the right to pollute? Readings include Walzer, Arrow, Rawls, Sen, Frey, Titmuss, and empirical cases.

PHIL 64S	Introduction to Environmental Philosophy	2	Environmental problems define and dominate the times. Climate Change threatens to displace and impoverish millions of people, species extinctions promise to reached unprecedented numbers, and sustainability has become a buzzword in discussions of responsible business practices. In this course we will explore some of the most pivotal environmental issues facing us today using the tools of philosophy. Together we'll ask questions such as: Are individuals or governments responsible for solving environmental problems? What objects should we care about in the natural world (animals, living things, ecosystems?), and what do we do when environmental problems force us to make tough choices in the face of competing values? Do we have responsibilities to future generations? This course will provide a foundation for thinking about these questions and for facing our environmental problems head on.
PHYSICS 19	How Things Work: An Introduction to Physics	3	Introduction to the principles of physics through familiar objects and phenomena, including airplanes, cameras, computers, engines, refrigerators, lightning, radio, microwave ovens, and fluorescent lights. Estimates of real quantities from simple calculations.
PHYSICS 240	Introduction to the Physics of Energy	3	Energy as a consumable. Forms and interconvertability. World joule budget. Equivalents in rivers, oil pipelines and nuclear weapons. Quantum mechanics of fire, batteries and fuel cells. Hydrocarbon and hydrogen synthesis. Fundamental limits to mechanical, electrical and magnetic strengths of materials. Flywheels, capacitors and high pressure tanks. Principles of AC and DC power transmission. Impossibility of pure electricity storage. Surge and peaking. Solar constant. Photovoltaic and thermal solar conversion. Physical limits on agriculture.
PHYSICS 241	Introduction to Nuclear Energy	3	Radioactivity. Elementary nuclear processes. Energetics of fission and fusion. Cross-sections and resonances. Fissionable and fertile isotopes. Neutron budgets. Light water, heavy water and graphite reactors. World nuclear energy production. World reserves of uranium and thorium. Plutonium, reprocessing and proliferation. Half lives of fission decay products and actinides made by neutron capture. Nuclear waste. Three Mile Island and Chernobyl. Molten sodium breeders. Generation-IV reactors. Inertial confinement and magnetic fusion. Laser compression. Fast neutron production and fission-fusion hybrids.
PHYSICS 25	Modern Physics	3	Introduction to modern physics. Relativity, quantum mechanics, atomic theory, radioactivity, nuclear reactions, nuclear structure, high energy physics, elementary particles, astrophysics, stellar evolution, and the big bang.
PHYSICS 25S	Modern Physics with Laboratory	4	For biology, social science, and premedical students. The sequence PHYSICS 21S, PHYSICS 23S and PHYSICS 25S fulfills, in nine weeks, the one-year college physics requirement with lab of most medical schools. Labs are an integrated part of the summer courses. Introduction to modern physics. Relativity, quantum mechanics, atomic theory, radioactivity, nuclear reactions, nuclear structure, high energy physics, elementary particles, astrophysics, stellar evolution, and the big bang.
PHYSICS 26	Modern Physics Laboratory	1	Guided hands-on and simulation-based exploration of concepts in modern physics, including special relativity, quantum mechanics and nuclear physics with an emphasis on student predictions, observations and explanations.

PHYSICS 70N	Modern Physics in Your Life	1	How does modern physics intersect with your everyday life? Topics may include the quantum nature of light, atomic physics and an introduction to semiconductor physics, applications to light sources (incandescent, fluorescent, light-emitting diodes, lasers) and light sensors (photodiodes and solar cells), introduction to nuclear physics (e.g., fission, fusion, interaction of radiation with matter).
PHYSICS 81N	Science on the Back of the Envelope	3	Understanding the complex world around us quantitatively, using order of magnitude estimates and dimensional analysis. Starting from a handful of fundamental constants of Nature, one can estimate complex quantities such as cosmological length and time scales, size of the atom, height of Mount Everest, speed of tsunami, energy density of fuels and climate effects. Through these examples students learn the art of deductive thinking, fundamentalnnprinciples of science and the beautiful unity of nature.
POLECON 230	Strategy Beyond Markets	2	This course develops techniques and tools to use in firms' strategic interactions beyond the market environment. We'll examine firms' interactions with stakeholders, constituents, and institutions, including interest groups, legislatures, regulatory agencies, courts, international organizations, and the public. Topics covered in the class include: environmental regulation, intellectual property, antitrust, bank bailouts, health care reform, carried interest in private equity, protectionist trade policies, strategic corporate social responsibility, and beyond market strategy for start-ups. The goal is to develop integrated strategies for optimal firm performance that combine strategies within and beyond markets.
POLECON 231	Strategy Beyond Markets: Challenges and Opportunities in Developing Economies	3	This course develops techniques and tools to use in firms' strategic interactions beyond the market environment. We'll examine firms' interactions with stakeholders, constituents, and institutions, including interest groups, legislatures, regulatory agencies, courts, international organizations, and the public.nnnTopics covered in the class include: environmental regulation, intellectual property, antitrust, bank bailouts, health care reform, carried interest in private equity, protectionist trade policies, strategic corporate social responsibility, and beyond market strategy for start-ups. The goal is to develop integrated strategies for optimal firm performance that combine strategies within and beyond markets.
POLECON 571	The Future of Growth: Developed and Developing World	2	The course deals with the recent (post war) sustained high growth in the developing world and its likely evolution and impact in the future. How are these kinds of growth rates possible? What accounts for the absence of growth in a part of the developing world? What are the key political ingredients? Attention will be given to the evolving global landscape surrounding this growth. What is the impact of this widening pattern of growth and are there natural brakes that may slow the process down or make it difficult for the non-G20 developing countries and their 1/3 of the world's population to start or sustain the high growth process. The class will attempt to identify and assess the impact of important global trends and challenges. Included in the latter will be governance issues. We will spend a little time on the impact of the 2008-2009 crisis, the transmission channels and lessons learned from the vantage point of developing countries.

POLISCI 19N	Politics of Energy Efficiency	5	We will examine the political context of energy efficiency and climate change. Why are some countries, such as Japan and France, able to achieve high levels of energy efficiency, while others, such as the United States and Australia, struggle to do so? What political factors faciliate or impede energy efficiency policies? Why is international cooperation on climate change so difficult?
POLISCI 340L	China and World Politics	5	The implications of the rise of China in contemporary world politics and for American foreign policy, including issues such as arms and nuclear proliferation, regional security arrangements, international trade and investment, human rights, environmental problems, and the Taiwan and Tibet questions.
PSYCH 141S	Health Psychology	3	Why is it so difficult for people to stick to an exercise plan? Why don't people take their doctor's advice? Why aren't public health announcements more effective? This course addresses these questions by providing an overview of health psychology: the scientific study of behaviors and cognitive processes related to health states. In this course, we will discuss the mind/body connection, the influence of social/cultural and physical environments on our health, cognitive processing of health information, health belief models, and the link between emotion and health. Understanding the interactions between these biological, psychological, and social influences on individuals' health states is crucial for developing effective health communication and intervention programs. We will approach all course topics from both theory-driven and applied perspectives.
PUBLPOL 125	Law and Public Policy	5	Do Super PACs and corporate lobbying corrupt democratic elections? Do Democratic and Republican economic proposals hold up to scrutiny? Can a state prevent you from buying and carrying a gun? How would Martin Luther King analyze American society, public policy and racial discourse had he lived to celebrate the 50th anniversary of his "I Have A Dream" speech this year? This seminar investigates the relationship between law and public policy on issues related to economic regulation, electoral politics and finance, civil rights, sexuality and culture. We will explore how law both facilitates and constrains public policy reforms in historical context and our own era of challenging budgetary pressures, intensive political division, and increasing socio-economic inequality. Class discussion will involve the close reading and interpretation of judicial opinions, legislation and other legal texts, interdisciplinary scholarship, and film.
PUBLPOL 135	Regional Politics and Decision Making in Silicon Valley	3	Dynamics of regional leadership and decision making in Silicon Valley, a complex region composed of 40 cities and four counties without any overarching framework for governance. Formal and informal institutions shaping outcomes in the region. Case studies include transportation, workforce development, housing and land use, and climate change.
PUBLPOL 154	Politics and Policy in California	5	State politics and policy making, including the role of the legislature, legislative leadership, the governor, special interests, campaign finance, the public, ballot initiatives, the state constitution, the media, and the role of research organizations. Case studies include pension reform, health care, term limits and other political reform measures, open primaries, infrastructure improvements, and the budget. Changes in constitutional and in state statutes that can improve policy making in California.

PUBLPOL 20SI	Business and Policy of Sustainability	1-2	This course will focus on designing and scaling best practices of sustainability through corporate actions and government legislation. The course is split into 3 parts. First, students will learn the basics of drafting early legislation and starting corporate initiatives in both the US and internationally. Second, students will disrupt the current framework by applying a design thinking approach to corporate initiatives and public policy. Third, the class will focus on scaling the initiatives to create a global impact.
PUBLPOL 228	International Problem-Solving Through NGOs: Policy, Players, Strategy, and Ethics	2	This course will focus on advanced international problem-solving through the lens of international NGOs, while integrating other relevant players that address global issues within a lens of ethics and accountability. Particular aspects of NGOs that will be assessed are: policy, business, strategy, and engagement with other players. Students will consider the major issues that international NGOs face in their effort to effect positive change in an increasingly complex global environment. The course draws heavily on a series of sophisticated case studies involving a variety of NGOs, areas of specialization, and geographic regions. Topics may include: poverty and famine; the natural resources curse; terrorism; HIV/AIDS and other epidemics and neglected diseases; natural disasters and emergencies; climate change; and contagion of unethical behavior. A final project tailored to each student's interest will be in lieu of a final exam. Students will have the opportunity to work with several internationally prominent guests.
PUBLPOL 294	Technology Policy	3-4	How the U.S. federal government promotes, uses, and regulates new technologies; how it decides technology policies; and debates over how to use technology to advance national goals. Topics: American attitudes towards technology; technologies for defense, homeland security, energy, health, and economic competitiveness; and when and how to regulate nanotechnology, medical enhancements, government surveillance, and Internet privacy.
PUBLPOL 353	Science and Technology Policy	4-5	U.S. policies for science and technology, political institutions that create and carry out these policies, processes for conducting science and developing technology, international aspects of science and technology, and the roles of scientists, engineers, and physicians in creating and implementing policy. Assignments: analyzing the politics of particular legislative proposals, assessing options for trying to reach a policy objective, and preparing mock memos and testimony.

PUBPOL 304A	Collective Action: Ethics and Policy	4	Individually rational actions can give rise to results that are collectively irrational. For example, the collective result of our consumption decisions is to warm the planet, destroy the world's fisheries, and increase reliance on factory farming; at the same time, the decisions of a single individual seem to have no tangible effect on such things. In light of this, what (if anything) are you as an individual required to do in these and other collective action situations, especially when others are not doing their part to prevent things from getting out of control? For example, are you required to reduce your carbon footprint and avoid products that are produced in ethically objectionable ways? Do you have a duty to vote? Is free-riding always ethically objectionable? Can you be required to 'cooperate' in a situation where you know that most others will 'defect'? Finally, from a real-world policy perspective, how can we bring about the best solutions to these and other collective action problems? Is the best policy response always a straightforward function of the variable features of each case? Interdisciplinary readings from authors in philosophy, politics, economics, and law such as Elinor Ostrom, Peter Singer, and Cass Sunstein.
PWR 1AT	A Mountain for Itself: The Rhetoric of Wildnerness	4	Focus on sustainability as a context for learning writing and rhetorical skills. Rhetorical and contextual analysis of readings; research; and argument based on sustainability concepts.
PWR 1CR	Writing Nature: Discourses in Ecology, Culture, and Technology	4	Rhetorical and contextual analysis of readings; research; and argument. Focus is on development of a substantive research-based argument using multiple sources. Individual conferences with instructor. Inquiry into human relationships with nature and how these influence ethical choices and social justice.
PWR 1CS	Debating the Environment	4	Focus on sustainability as a context for learning writing and rhetorical skills. Rhetorical and contextual analysis of readings; research; and argument based on sustainability concepts.
PWR 1GMK	Pure and Unadulterated: The Rhetoric of Contamination	4	Focus on sustainability as a context for learning writing and rhetorical skills. Rhetorical and contextual analysis of readings; research; and argument based on sustainability concepts.
PWR 1MG	The Rhetoric of the American West	4	Focus on sustainability as a context for learning writing and rhetorical skills. Rhetorical and contextual analysis of readings; research; and argument based on sustainability concepts.
PWR 1RC	Domestication: How Humans Shape the Natural World	4	Focus on sustainability as a context for learning writing and rhetorical skills. Rhetorical and contextual analysis of readings; research; and argument based on sustainability concepts.
PWR 1VS	Eating-Animals: The Rhetoric of Animals, Food, and the Environment	4	Focus on sustainability as a context for learning writing and rhetorical skills. Rhetorical and contextual analysis of readings; research; and argument based on sustainability concepts.
PWR 2CR	Communicating Science and the Environment	4	Further work in developing skills in argument and research-based writing, with emphasis on both written and oral/multimedia presentation of research. Examination of the motivations and appeals of environmental arguments, considering underlying assumptions and contexts of time, culture, audience, purpose, and mode of delivery. Participation in Community Writing Project, working with local nonprofit environmental organizations to produce real-world writing, multimedia, and/or speaking projects on these organizations' behalf. Work in the community will form the basis of the major research project. Service Learning Course (certified by Haas Center).

PWR 2KM	A Planet on the Edge: The Rhetoric of Sustainable Energy	4	Further work in developing skills in argument and research-based writing, with emphasis on both written and oral/multimedia presentation of research. Focus on the rhetoric and ethics of sustainable energy, investigating both the alarmism and optimism which fuel this debate.
REES 219	The Russian Economy	4-5	Brief introduction to the economic history of Russia, general overview of the modern Russian economy with analysis of its macroeconomic features and dynamics, industrial structure, and the major institutional features that are important for understanding Russian economic development. The period of transition from Soviet-type planned economy to a market economy and market reforms (1991-1998), the period of economic growth (1999-2007), and the economic development of Russia during the current global crisis of 2008-2010. Analysis of Russia's social structure and social policy, labor markets, the regional structure of the economy, the role of the state, and major Russian industries (oil, metals, machinery). Emphasis on the specific institutional aspects that have shaped Russia's economic development.
SIW 133	How a "Green" Idea Becomes Law: Current State of US Environmental Law and Policy	5	Intense study of U.S. environmental law and policy for students in the Stanford in Washington program.
SOC 378	Seminar on Institutional Theory and World Society	1-5	Sociological analyses of the rise and impact of the expanded modern world order, with its internationalized organizations and globalized discourse. Consequences for national and local society: education, political organization, economic structure, the environment, and science. The centrality of the individual and the rationalized organization as legitimated actors.
STATS 360	Advanced Statistical Methods for Earth System Analysis	3	Introduction for graduate students to important issues in data analysis relevant to earth system studies. Emphasis on concepts and implementation (in R), rather than formal proofs. Likely topics include the bootstrap, non-parametric methods, regression in the presence of spatial and temporal correlation, measurement errors, extreme value distributions, and high-dimensional regressions. Topics subject to change each year.
STRAMGT 583	The Challenges in/with China	2	This course is designed to provide MBAs with a solid grasp of the socio-economic, business and political situation in China (with its challenges for China, the rest of the world and the planet). It will identify the multicausality conducive to the achievements and the performance of China (a "Chinese Renaissance") while assessing some of the important issues faced by China today. The dysfunctions brought by success will be discussed with their implications for foreign partners operating in China. Learning will be drawn from recent examples of corporate behavior in China and from Chinese strategies outside China. From the course and with a prospective perspective - we will explore alternative strategic approaches and responsible management practices likely to make less difficult the maintenance of a sustainable, mutually rewarding interdependence between China and the rest of the world.nnThe course will rely upon different pedagogical methods and use a number of recent cases and research results.

STS 140	Science, Technology and Politics	4	This course will critically interrogate the relationship between science and technology and politics. Politics plays a significant role in the production of scientific knowledge and technological artifacts. Science and technology in turn constitute crucial elements of politics and governance in modern democracy. This course will explore these interactions through key STS texts and case studies of such issues as climate change, race science, urban planning, voting machines, and information technology in social movements.
STS 190	Issues in Technology and the Environment	4	Humans have long shaped and reshaped the natural world with technologies. Once a menacing presence to conquer or an infinite reserve for resources, nature is now understood to require constant protection from damage and loss. This course will examine humanity's varied relationship with the environment, with a focus on the role of technology. Topics include: industrialization, modernism, nuclear technology, and biotechnology. Students will explore theoretical and methodological approaches in STS and conduct original research that addresses this human-nature-technology nexus. Preference to STS juniors.
STS 200A	STS Senior Capstone: Food and Society: Politics, Culture, and Technology	5	Food and Society: Politics, Culture and Technology: This course will examine how politics, culture, and technology intersect in our food practices. Through a survey of academic, journalistic, and artistic works on food and eating, the course will explore a set of key analytical frameworks and conceptual tools in STS. The topics covered include: the industrialization of agriculture; technology and the modes of eating (e.g., the rise of restaurants); food taboos; globalization and local foodways; food and environmentalism; and new technologies in production (e.g., genetically modified food).
STS 200B	STS Senor Capstone: Car Culture	5	Since at least the 50s, the U.S. has been notorious as a nation in love with the car. An examination of this premise, analyzing new methods of production brought by automobile manufacture, how automobiles shaped urban growth, debates about pollution and environmental degradation, and debates around auto safety. How the car has influenced American practices including courting, eating out, and suburban living.
STW 198J	Environment and Energy Policy	5	Intense study of environment and energy policy for students in the Stanford in Washington program.
STW 198S	Environment and Energy Policy	5	Intense study of environment and energy policy for students in the Stanford in Washington program.
STW 198W	Environmental Education	5	Intense study on the environmental education system for students in the Stanford in Washington program.
STW 198X	International Environmental Policy	5	Intense study of international environmental policy for students in the Stanford in Washington program.
SURG 211B	Emergency Medical Technician Training	3-4	Approach to traumatic injuries. Topics include head, neck, and trunk injuries, bleeding and shock, burn emergencies, and environmental emergencies. Lectures, practicals, and applications. Students taking the class for 4 units complete additional online FEMA training and additional clinical rotations. Upon completion of SURG 111A,B,C or 211A,B,C, students are eligible to sit for the National Registry EMT licensure exam. Freshmen and Sophomores are highly encouraged to apply.

SURG 222	Biosecurity and Bioterrorism Response	2-6	This course provides an overview of the most pressing biosecurity issues facing the world today. Guest lecturers this year include former Secretary of State Condoleezza Rice, former Special Assistant on BioSecurity to Presidents Clinton and Bush Jr. Dr. Ken Bernard, Chief Medical Officer of the Homeland Security Department Dr. Alex Garza, eminent scientists, innovators and physicians in the field, and leaders of relevant technology companies. The class explores how well the US and global healthcare systems are prepared to withstand a pandemic or a bioterrorism attack, how the medical/healthcare field, government, and the technology sectors are involved in biosecurity and pandemic or bioterrorism response and how they interface, the rise of synthetic biology with its promises and threats, global bio-surveillance, making the medical diagnosis, isolation, containment, hospital surge capacity, stockpiling and distribution of countermeasures, food and agriculture biosecurity, new promising technologies for detection of bio-threats and countermeasures. Open to medical, graduate, and undergraduate students. No prior background in biology necessary.
SURG 223	Wilderness Medicine	2-3	Open to all students. Wilderness-related illnesses and injuries; a framework for evaluation and treatment of emergencies in the backcountry. Hands-on clinical skills. Topics include high altitude medicine, hypothermia, envenomations, search and rescue, improvisation, and survival medicine. Includes opportunity for certification in Wilderness First Aid (WFA). 3 units includes participation in an Emergency Department observation shift and a day-long field-trip for hands-on field work.
SURG 231	Haiti and Healthcare		Originally developed to highlight healthcare in exreme poverty in Haiti, related lectures have been added covering healthcare in resource poor environments with the objective to introduce students to the complexity and unique problems of working in the Third World's healthcare morass.

THINK 25	Evolution on Earth	4	How does evolution, the foundation of biology, underlie the diversification of life on earth? What are the mechanisms of evolution, and how are they discovered and explored? What are the practical implications of evolution for agriculture, medicine, and the future of life on earth? The history of life on earth is inextricably intertwined with the history of geological change on earth. From a primordial soup containing building block molecules emerged early forms of single-celled organisms, which existed for billions of years as continents formed, moved, and dissolved. Multicellular forms evolved and changed as a result of atmospheric changes, the cooling of the earth, and the contributions of other living organisms. Early ideas about biological evolution came from young people who went on wild adventures. Their observations generated ideas about what must have happened; but since, at the time, little was known about the mechanisms of inheritance, they were never to know how it happened. In time, two major advances came along: a much more comprehensive fossil record that substantiated many of their ideas, and a deep understanding of genetic mechanisms of inheritance. In parallel, the idea of geologic forms as dynamic, especially vulcanism and plate tectonics, provided a new narrative of earth history that informed ideas about spreading and changing life forms. Then mechanisms of developmental biology showed how inherited genes carry out recipes for building bodies with certain structures. We will examine evolution from scientific, historical, and artistic perspectives, including evolution of microbes, plants, animals, and humans, and implications of evolution for medicine. The course will include introductory lectures, some in class and some online, discussion sessions, and three team projects for each student. Student teams will examine topics of their choosing in depth and create reports that will be assembled into a comprehensive book.
THINK 33	The Water Course	4	How can we balance all the competing, and growing, demands for freshwater? When you turn on your tap, where does the water come from? Water is essential for life. But, around the world, governments and citizens are challenged to balance the human demands on our freshwater resources, while protecting the integrity of natural ecosystems. At the core of the challenge is our limited understanding, in many parts of the world, of the watershed-scale hydrologic cycle - the course that the water follows from rainfall, to river, to groundwater, to ocean, to atmosphere, and back again. The Water Course takes students along that course, exploring the role that natural systems and human systems play in impacting both the quantity and quality of our freshwater. We will consider the scientific and ethical questions surrounding decisions about water allocation, and discuss new scientific methods that provide support for science-based decision making in the management of freshwater resources. You will connect global-scale issues to your personal experiences with freshwater through a quarter-long project investigating both water quantity and water quality in your hometown and surrounding watershed. You will produce a numerical model, and make approximations, to describe a complex natural system. Using online resources you will explore the pathway that water takes from rainfall to your tap.

THINK 8	Sustainability and Collapse	4	What does it mean to live sustainably? How do our different definitions of nature - scientific, literary, cultural, and historical - shape the way we answer that question? Sustainability and Collapse will explore what people in different places and periods of time have envisioned as successful ways of living with nature and how such ways of life have come under pressure. We will focus particularly on the interface between scientific and humanistic approaches to questions of environmental sustainability through a study of novels, historical texts, and works of biogeography. You will learn to ask how textual and visual images inform our ideas about what it means to live sustainably. We will then consider whether those ideas are in accordance with or in conflict with scientific understandings of human uses of nature. This course takes on some of the fundamental problems that presently confront our global community.
URBANST 113	Introduction to Urban Design: Contemporary Urban Design in Theory and Practice	5	Comparative studies in neighborhood conservation, inner city regeneration, and growth policies for metropolitan regions. Lecture, discussion, and research focusing on case studies from North America and abroad, team urban design projects.
URBANST 121	Public Scholarship and Social Change	2	Introduces students to the diverse ways of "doing" public/community-engaged scholarship, including public interest and public policy-oriented research, design research, social entrepreneurship, activist/advocacy and community-based research models. Through a multidisciplinary set of case studies of actual research/action projects in the US and abroad, students will compare and assess research models in terms of methodological approach, academic rigor, control and ownership of the research process, means and modes of data dissemination, researcher subjectivity, depth of community partnership, and relative potential for sustainable, long-term community impact. The course material is designed to provide students with a broad framework and context to imagine how to produce their own scholarship/research as a form of public service and social transformation.
URBANST 132	Concepts and Analytic Skills for the Social Sector	4	How to create and grow innovative, not-for-profit organizations and for-profit enterprises which have the primary goal of solving social and environmental problems. Topics include organizational mission, strategy, communications/marketing, financing and evaluation. Opportunities and limits of methods from the for-profit sector to meet social goals. Perspectives from the field of social entrepreneurship. Focus is on integrating theory with practical applications.
URBANST 150	History of San Francisco	5	This class will examine the history of San Francisco, with a focus on social and political history. Possible topics include Indians and Spanish settlers, the Gold Rush, immigration, public culture, Progressive Era reform, the earthquake and fire of 1906 and its legacy, labor and unionism, race and civil rights, sexuality and politics, and redevelopment.

URBANST 163	Land Use Control	4	Methods of land use control related to the pattern and scale of development and the protection of land and water resources. Emphasis is on the relationship between the desired land use goal and geographical landscape, physical externalities, land use law, and regulatory agencies. Topics include the historical roots of modern land use controls; urban reforms of the 19th century; private ownership of land; zoning; local, state, and federal land use regulation; and land trusts preservation. Smart growth, environmental impact consideration, private property rights, and special purpose agencies are related to current issues.
URBANST 166	East Palo Alto: Reading Urban Change	5	This course is an introduction to African-American Political movements of the period after 1930, with special emphasis on mass protest and civil rights activism as well as leaders such as W. E. B. Du Bois, Thurgood Marshall, Martin Luther King, Jr., Malcom X, Jesse Jackson, and Barack Obama. The lectures will utilize audio-visual materials extensively, and the exams will cover these materials as well as the traditional lectures. In addition to attending lectures, students are encouraged to undertake research projects.
URBANST 167	The Automobile and the City	4	This course will examine the impact of the automobile on urban development and the social life of the modern city from three perspectives. First, as Auto-Utopia: a look at the golden age of automobiling during the early and late 20th century when the private car and the truck expanded the full range of opportunities for the economy and for both urban and rural residents of the modern world. Second, Auto-Dystopia: an examination of the negative impacts of the automobile that emerged in the late 20th and early 21st centuries in regard to safety, congestion, pollution, sustainability, and the development of a monoculture of the automobile in urban transportation. And third, Auto-Futures: a look at the ways that urban society -- both in the developed world and in the emerging economies of Asia, Africa, and Latin America -- will plan for and manage a multi-modal transportation system (walking, cycling, transit, and the achievement of a better jobs/housing balance) in which the automobile will be one of many options and will serve both private and public needs.

URBANST 172	Design Approaches to Mending a City: Rethinking the 101 in East Palo Alto	4	The omnipresence of automobile infrastructure negotiating the urban, suburban, and rural landscapes emphasizes the prioritization of this mode of transportation in the United States. Although the overlap of highway and urban area is sometimes addressed (and re-addressed), it tends to create sub-districts, fragmentation, and unnecessary conditions of separation. While serving as an important circulation network on the west coast, connecting Los Angeles to Seattle, the infrastructure of Highway 101 cuts through various communities, at times creating division at the local scale. One of the more marked manifestations of this division is in East Palo Alto, where the highway separates residents on the west side from schools and activities on the east side, acting as a barrier that must be navigated by car. nnThis studio aims to articulate the issues created by the presence of the highway and study design solutions that not only mitigate the presence of these two systems (highway and community) at a general level, but develop strategic approaches to the issues facing the specific area. In this regard, students will engage with the site, community members, and local officials. They will focus on the issues and impact of transportation infrastructure and offer design oriented ideas and responses for addressing the intersection of urban development and highway systems.
URBANST 190	Urban Professions Seminar	1	Workshop. Contemporary practice of urban design and planning, community development, urban education, public service law, and related fields. Topics depend partly on student interests. Bay Area professionals lecture and respond to questions concerning their day-to-day work, impressions of their field, and the academic background recommended for their work.