Environmental Science, Policy and Management

The Environmental Science, Policy, and Management (ESPM) Graduate Program provides a wealth of opportunities for students interested in careers ranging from academic research to teaching, government, and non-governmental agencies. Our faculty (http://ourenvironment.berkeley.edu/people/faculty-specialists) are internationally recognized, and ESPM is the campus hub for linkages to other renowned Berkeley programs such as the Energy and Resources Group (http://erg.berkeley.edu) , Agricultural and Resource Economics (http://areweb.berkeley.edu) , the Goldman School of Public Policy (http://gspp.berkeley.edu) , Berkeley Natural History Museums (http://bnhm.berkeley.edu) , and many more. The Berkeley campus maintains close ties to world-class research facilities at the Lawrence Berkeley National Laboratory, the US Geological Survey, Stanford University, and many other locations.

Students admitted to our program work with their advisor to select courses, individualized training, and projects to meet their interests and goals. Our core graduate courses provide an introduction to the expertise and available resources within our Department and help students apply for funding opportunities early in their graduate program. The PhD program (http://ourenvironment.berkeley.edu/graduate-programs/degree-programs/the-phd-program) is the main graduate program in ESPM, though we offer limited numbers of MS degrees in our specialized Master of Range Management (http://ourenvironment.berkeley.edu/graduate-programs/degrees/ms-range-management) and Master of Forestry (http://ourenvironment.berkeley.edu/graduate-programs/degree-programs/master-of-forestry) programs.

The goal of the program is to provide both a strong disciplinary education and broadly based experience in cross-disciplinary communication and problem solving. To achieve this, the program leading to the PhD in environmental science, policy, and management will require that a student complete three core courses, and coursework in the following four broad areas: disciplinary emphasis, area of specialization, research skills, and experiential breadth.

Students will be required to demonstrate competence in one of the three fields of emphasis defined below. Specific coursework within each field will be chosen by the guiding committee in conjunction with the student and approved by the graduate adviser. The three fields provide flexibility within a clear program structure.

Disciplinary Emphasis

The disciplinary emphasis is the broadest academic area encompassing the student's interests. The three disciplinary emphases within the department are ecosystem sciences, organisms and environment, and society and environment. A student pursuing a strongly interdisciplinary program may study more than one of these disciplines in depth.

1. **Ecosystem Sciences** : The Ecosystem Sciences Division increases knowledge of the biological, chemical, and physical processes that determine terrestrial ecosystem dynamics in order to provide a scientific basis for management and to analyze the adverse stresses that society places on terrestrial ecosystems. Central to this is collaboration between biological and physical scientists, leading to an integrated understanding of ecosystem composition, structure, and function, as well as to the extension of basic research findings through modeling, implementation, and educational activities. The principal research and teaching efforts are directed toward forests, grasslands, and agricultural lands, but also contiguous aquatic, wetland, and marine ecosystems and the atmosphere. Investigation is carried out over a wide range of spatial and temporal scales, with emphasis on extending understanding of processes derived from research at smaller scales to landscape, regional, and global scales. The role of human activities, including ecosystem management scenarios, is an integral component.
2. **Organisms and Environment** : The mission of the Division of Organisms and Environment is to use fundamental research in ecology and evolutionary biology to address critical environmental issues and to solve vital environmental problems. Research interests in this division are wide ranging, from the molecular to whole ecosystems, providing a strong integration of biological processes and a diversity of intellectual challenges for graduate students. Systematics and biodiversity science, behavior and neurobiology, ecology and biological control, and food systems, are notable strengths in Organisms and Environment. Other research emphases include environmental toxicology, medical entomology, invasive species, and organism-microbe interactions.
3. **Society and Environment** : Faculty and students of the Division of Society and Environment study how social distributions of power and resources affect environmental dynamics and their social consequences. Research and teaching focus on how cultural, social, political, and economic institutions affect the treatment of natural resources and interactions with environmental phenomena; and on the practical processes, methods, and implications of forming, choosing, and applying policy and management regimes in different institutional frameworks and environmental settings. This knowledge is applied to concrete problems in human-ecosystem relations from local to global scales in a wide variety of cultural and historical contexts. Theories and methods are chosen from the full range of science and interpretive analysis to satisfy the standards of both significant scholarship and effective practical contribution for the problem of interest.

Area of Specialization

The area of specialization is a narrower field within the context of the disciplinary emphasis. Some examples of these areas are microbial community ecology, ecosystem function, arthropod population and community ecology, biological control of arthropods, arthropod biodiversity science, American environmental history and policy, international forest management, biogeochemistry, Mediterranean grassland ecosystems, remote sensing, and forest management.

Admission to the University

Uniform minimum requirements for admission

The following minimum requirements apply to all programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A minimum grade-point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g. Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 570 on the paper-and-pencil test, 230 on

the computer-based test, 90 on the iBT test, or an IELTS Band score of at least 7 (note that individual programs may set higher levels for any of these); and

4. Enough undergraduate training to do graduate work in the given field.

Applicants who already hold a graduate degree

The Graduate Council views academic degrees as evidence of broad research training, not as vocational training certificates; therefore, applicants who already have academic graduate degrees should be able to take up new subject matter on a serious level without undertaking a graduate program, unless the fields are completely dissimilar.

Programs may consider students for an additional academic master's or professional master's degree if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may only apply to one single degree program or one concurrent degree program per admission cycle.

Any applicant who was previously registered at Berkeley as a graduate student, no matter how briefly, must apply for readmission, not admission, even if the new application is to a different program.

Required documents for admissions applications

1. **Transcripts:** Upload unofficial transcripts with the application for the departmental initial review. Official transcripts of all college-level work will be required **if admitted**. Official transcripts must be in sealed envelopes as issued by the school(s) you have attended. Request a current transcript from every post-secondary school that you have attended, including community colleges, summer sessions, and extension programs.
   If you have attended Berkeley, upload unofficial transcript with the application for the departmental initial review. Official transcript with evidence of degree conferral ***will not*** be required if admitted.
2. **Letters of recommendation:** Applicants can request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries in which the official language is not English are required to submit official evidence of English language proficiency. This requirement applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, and most European countries. However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a U.S. university may submit an official transcript from the U.S. university to fulfill this requirement. The following courses will not fulfill this requirement: 1) courses in English as a Second Language, 2) courses conducted in a language other than English, 3) courses that will be completed after the application is submitted, and 4) courses of a non-academic nature. If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests.

Admission to the Program

Applicants for admission to the graduate program must hold a bachelor's degree from a university or college with curricula and standards equivalent to those of the University of California. The completed undergraduate program should normally be in a field relevant to the disciplinary emphasis chosen. Applicants without this background may be admitted with the understanding that their coursework must compensate for deficiencies in their preparation. We suggest that prospective applicants consult with faculty or the Graduate Student Services Office (http://ourenvironment.berkeley.edu/graduate-programs/graduate-student-services) for advice and course recommendations.

It is critical that all applicants identify on their application faculty whose research and work overlap with their strengths and interests. Without this information, the admission committee will not be able to evaluate your application properly. Applicants are strongly encouraged to contact faculty during the application process. Faculty sponsorship of entering graduate students will be determined once all applications have been reviewed and final admission offers have been made. The ESPM admission committee, not individual faculty, makes the final decisions on who will be offered admission to the program. Applications are accepted for the fall semester only.

Time to Advancement

Curriculum

Courses Required

Program of study decided by the Guiding Committee with the student per research interests requires four components:		
Disciplinary Emphasis (broad area) from Ecosystem Sciences; Organisms & Environment; Society & Environment		
Area of Specialization (narrower field within the Disciplinary Emphasis)		
Research Skills		
Experiential Breadth		
ESPM 201A	Research Approaches in Environmental Science, Policy, and Management	3
ESPM 201C	Environmental Forum	1
ESPM 201S	Environmental Science, Policy, and Management Colloquium	1

Environmental Science, Policy and Management

ESPM C200 Principles of Phylogenetics 4 Units
The core theory and methodology for comparative biology, beginning with issues in building phylogenetic trees, with emphases on both morphology and molecules, and both living and fossil organisms. Also covers the many applications of phylogenetic trees to systematics, biogeography, speciation, conservation, population genetics, ecology, behavior, development, functional morphology, and macroevolution that have revolutionized those fields. Labs are closely integrated with lectures and cover the major algorithms and computer software used to implement these approaches. Requirements include participation in discussions, two exams, and a term project.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructors: Ackerly, Mishler, Will

Also listed as: INTEGBI C200

ESPM 201A Research Approaches in Environmental Science, Policy, and Management 3 Units
Research projects and approaches in environmental science, policy, and management. An introduction to the diverse ways environmental problems are researched, comparing the approaches and methods of various disciplines represented among faculty and students. This course is the first of the core course sequence required for all ESPM graduate students.
Rules & Requirements

Prerequisites: Graduate standing in ESPM

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Mills

Formerly known as: 200B

ESPM 201C Environmental Forum 1 Unit
Presentation and analysis of current topics in environmental science, policy, and management. This course is required for all ESPM doctoral students.
Rules & Requirements

Prerequisites: Graduate standing in ESPM

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Formerly known as: 200C

ESPM 201S Environmental Science, Policy, and Management Colloquium 1 Unit
Seminars for the presentation and discussion of original work by faculty, visiting scholars, and graduate students. Core course for the ESPM graduate program.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

ESPM C204 Research Reviews in Animal Behavior: Behavior Review 1 Unit
This course will provide a rigorous, critical review of current research in animal behavior. Emphases will include hypothesis testing and experimental design, as well as methods of data collection and analysis. Each week, a student in the course will present original research in the form of a seminar presentation, grant proposal, or manuscript. Through discussion with seminar participants, presenters will gain critical feedback regarding their research.
Rules & Requirements

Prerequisites: Graduate standing, basic course in animal behavior. Instructor approval required

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructors: Lacey, Caldwell, Bentley, Elias

Also listed as: INTEGBI C204

ESPM 205 Quantitative Methods for Ecological and Environmental Modeling 3 Units
This course will review the background mathematical and statistical tools necessary for students interested in pursuing ecological and environmental modeling. Topics include linear algebra; difference equation, ordinary differential equation, and partial differential equation models; stochastic processes; parameter estimation; and a number of statistical techniques. This course will be recommended as a prerequisite for advanced modeling courses in Integrative Biology, Energy and Resources Group, and Environmental Science, Policy, and Management.
Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Wayne Getz

ESPM C205 Quantitative Methods for Ecological and Environmental Modeling 3 Units
This course will review the background mathematical and statistical tools necessary for students interested in pursuing ecological and environmental modeling. Topics include linear algebra; difference equation, ordinary differential equation, and partial differential equation models; stochastic processes; parameter estimation; and a number of statistical techniques. This course will be recommended as a prerequisite for advanced modeling courses in Integrative Biology, Energy and Resources Group, and Environmental Science, Policy, and Management.
Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Also listed as: ENE,RES C205/INTEGBI C205

ESPM 206 Animal Communication 2 Units
The objective of the course is to explore major topics in animal communication. Topics each year will focus on a different sensory modality and range from visual, acoustic, and chemical senses. Due to the interdisciplinary nature of the study of communication, over the course of the semester, we will draw on a variety of disciplines (including cell biology, ecology, evolution, genetics, neurophysiology, and physics) to understand the mechanisms, function, and evolution of communication.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructor: Elias

ESPM 209 Pathogen and Disease Ecology 1 Unit
Study and discussion of current topics in pathogen and disease ecology.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructor: Almeida

ESPM 210 Spatial Data Analysis for Natural Resources 3 Units
An introduction to natural resource spatial data analysis. Topics to be covered include spatial sampling, quadrat analysis, distance methods, spatial point patterns and Ripley's K function, spatial autocorrelation, and geostatistics (Kriging). Readings will cover applications in various natural resource fields as well as general theory.
Rules & Requirements

Prerequisites: One year of upper division probability and statistics, one course in multivariate analysis, or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Biging

ESPM C211 Modeling Ecological and Meteorological Phenomena 3 Units
Modeling methods in ecology and meteorology; stability analysis; effects of anthropogenic stress on natural systems. Offered alternate years.
Rules & Requirements

Prerequisites: Integrative Biology 102 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Harte

Also listed as: ENE,RES C202

ESPM 215 Hierarchical Statistical Modeling in Environmental Science 2 Units
Hierarchical statistical models include generalized linear mixed models, generalized additive mixed models, state-space models for time-series data, and random field models for spatial data. Introduction to formulation and analysis of such models with frequentist methods, including maximum likelihood via numerical integration and restricted maximum likelihood, and Bayesian methods, including Markov chain Monte Carlo. Background in relevant probability theory.
Rules & Requirements

Prerequisites: Calculus and experience with common statistical methods such as linear regression, or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructor: de Valpine

ESPM C216 Freshwater Ecology 3 Units
This graduate course will combine formal lectures and discussion, with the overall goal of exposing students to general concepts in freshwater ecology. We will discuss a broad range of topics including freshwater environments and biota, natural selection and adaptive evolution, food webs and trophic cascades, cross-ecosystem linkages, and social-ecological resilience of freshwater ecosystems under global change. Upper division undergraduates are welcome, with permission of the instructors.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructors: Carlson, Power

Also listed as: INTEGBI C216

ESPM 217 Political Economy of Climate Change 3 Units
This course examines the comparative and global political economy of climate change, with a focus on the politics of climate change mitigation in the energy sector. Key themes are the choice of policy strategies and policy instruments, industry and climate policy, global institutions and collective action, markets and technological change, and economic and geo-political transformations in response to climate change. The courses combines theoretical readings with in-depth case studies.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Meckling

ESPM C220 Stable Isotope Ecology 5 Units
Course focuses on principles and applications of stable isotope chemistry as applied to the broad science of ecology. Lecture topics include principles of isotope behavior and chemistry, and isotope measurements in the context of terrestrial, aquatic, and marine ecological processes and problems. Students participate in a set of laboratory exercises involving preparation of samples of choice for isotopic analyses, the use of the mass spectrometer and optical analysis systems, and the anlaysis of data.
Rules & Requirements

Prerequisites: Graduate standing

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructors: Amundson, Dawson, Mambelli

Also listed as: EPS C241/INTEGBI C227

ESPM 222 Surface and Colloid Chemistry of Natural Particles 3 Units
Structure and coordination chemistry of natural adsorbent particles in aqueous systems; solute adsorption mechanisms and theoretical models; interparticle forces and colloidal phenomena; applications to biogeochemistry and contaminant hydrology.
Rules & Requirements

Prerequisites: 126 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Sposito

ESPM C225 Isotopics 2 Units
This seminar will explore current topics that employ the use of stable isotopes. Discussion topics include the areas of biology, paleontology, biogeochemistry, soil science, and atmospheric science. Students will be required to lead at least one discussion of relevant literature in the topic area.
Hours & Format

Fall and/or spring: 10 weeks - 3 hours of seminar per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructors: Amundson, Dawson, Mambelli

Also listed as: INTEGBI C226

ESPM 226 Interdisciplinary Food and Agriculture Studies 3 Units
A graduate seminar exploring the ecological, social, and economic risks inherent in different forms of agriculture, from highly diversified, agroecological farming systems to industrialized agriculture.
We will examine how different farm management techniques, government policies, supply chains, R&D, technology, and science may influence various risks and uncertainties, including climate change, agrobiodiversity, farmer livelihoods, food safety, public health, and nutrition.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructors: Iles, Kremen

ESPM 227 Science Communication 2 Units
Effective communication is an important skill that all scientists should master. There are many different forms of communication, and these require different approaches and techniques. The goal of this course is to provide students with the skills to communicate scientific findings to a wide range of audiences. We will discuss approaches to communicating our findings and those of others to other scientists, the public, and the media. We will then prepare and practice communicating through papers, proposals, presentations, sound bites, and podcasts. Exercises and assignments are designed to give students hands on experience developing their own stories and packaging them to selected audiences.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructor: Silver

ESPM 228 Advanced Topics in Biometeorology and Micrometeorology 2 Units
Measurement and modeling of trace gases and energy between the terrestrial biosphere and atmosphere. Micrometeorological flux measurement methods, including eddy covariance, profile, and eddy accumulation methods. A hierarchy of biophysical models are discussed for interpreting flux measurements. Information and theory on big-leaf, two-layer, and multi-layer models that couple energy, water, and carbon to predict trace gas fluxes are presented. How models integrate information from leaf to canopy to landscape scales is discussed.
Rules & Requirements

Prerequisites: C129 or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Baldocchi

ESPM 230 Sociology of Agriculture 4 Units
This graduate seminar explores the sociology of agriculture and food systems, addressing key theories and topics in the field. We begin with the antecedents of the sociology of agriculture, including foundation classical agrarian theories and an overview of the field, followed by topics ranging from pesticide drift to agricultural labor injustice to food sovereignty movements and more. This course is most appropriate for students with some background in agri-food and social systems.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: De Master

ESPM 233 Geographic Information Systems for Environmental Science and Management 3 Units
The objectives of the course are to: 1) review the GIS basics (data, analysis, and product generation) with special reference to data used in managing California environments; 2) understand the issues surrounding, and algorithms used in, a particular GIS application; and 3) develop an operational GIS project in a chosen area. This course is divided into three sections: 1) an intensive GIS fundamentals section covering geospatial data input, manipulation, analysis, and effective communication using common geospatial data from California sources; 2) a section that discusses linkages with other GIScience disciplines; 3) a topic based case-study portion; and 4) a project development phase. Topics will need to have management appplicability for an agency, not-for-profit, or similar type of group involved in environmental management. There will be lectures and labs throughout the class, although lab time nearer the end of class will be focused on class projects. Reading will be assigned throughout, and class discussion held. The final class period will be used as an "illustrated paper" session, in which final projects are displayed and discussed.
Rules & Requirements

Prerequisites: Introduction to Geographic Information Systems (GIS)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Kelly

ESPM C234 Green Chemistry: An Interdisciplonary Approach to Sustainability 3 Units
Meeting the challenge of global sustainability will require interdisciplinary approaches to research and education, as well as the integration of this new knowledge into society, policymaking, and business. Green Chemistry is an intellectual framework created to meet these challenges and guide technological development. It encourages the design and production of safer and more sustainable chemicals and products.
Rules & Requirements

Prerequisites: One year of chemistry, including a semester of organic chemistry, or consent of instructors based on previous experience

Hours & Format

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

Summer: 6 weeks - 20 hours of lecture per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructors: Arnold, Bergman, Guth, Iles, Kokai, Mulvihill, Schwarzman, Wilson

Also listed as: CHEM C234/PB HLTH C234

ESPM 249 Bioethics, Law, and the Life Sciences 3 Units
Developments in biotechnology and the life sciences are unsettling legal and policy approaches to intellectual property, reproduction, health care, medical research, and the criminal justice system. Through reading primary materials and relevant secondary sources, this course investigates ethical, legal, and policy problems associated with these developments, and explores possible solutions.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Winickoff

ESPM 250 Environmental History 4 Units
A critical survey of classical and recent literature in the field of environmental history, philosophy, and ethics, with special emphasis on the American environment. Topics will include environmental historiography, theories of environmental history, and the relationships between environmental history, philosophy, ethics, ecology, and policy.
Rules & Requirements

Prerequisites: Upper division course in history or history of science or a social science

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Merchant

ESPM 251 International Conservation and Development Policy 3 Units
Changes in Third World rural economy, ecology, and environment and ways in which these are affected by development policies. Historical dimensions of Third World environmental problems. Changing patterns of rural production (especially food) and resource use; alternative theories of natural resource and socioeconomic development; linkages between socioeconomy and environment in agrarian change and development policy; technology and resource control; conservation and development problems.
Rules & Requirements

Prerequisites: One upper division course in international development

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Carr

ESPM C252 Topics in Science and Technology Studies 3 Units
This course provides a strong foundation for graduate work in STS, a multidisciplinary field with a signature capacity to rethink the relationship among science, technology, and political and social life. From climate change to population genomics, access to medicines and the impact of new media, the problems of our time are simultaneously scientific and social, technological and political, ethical and economic.
Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Also listed as: ANTHRO C254/HISTORY C250/STS C200

ESPM 253 Advanced Readings in Political Ecology 4 Units
Critique and comparison of literature in political ecology--an approach to sociological analysis of environmental change focusing on environmental conflict. Initial sessions address the definition of political ecology, its origins, and the politics and discourses of natural resource management. Literature includes domestic and international research involving the combination of social and environmental history, local perspectives, and political economy to discuss accounts of social and environmental change.
Rules & Requirements

Prerequisites: Consent of instructor; significant background in social theory

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Peluso

ESPM C254 Ethnic and Cultural Diversity in Health Status 3 Units
Focus on ethnic and cultural diversity in health behavior as a basis for public health programs. Consideration of U.S. ethnic minority groups and cultural groups in non-Western societies. Health status and behavior examined in context of relevant social and anthropological theory (social class, acculturation, political economy). Influence of socio-cultural background on concepts of health, illness, and health-seeking behavior. Implications for planning public health programs and policies.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Morello-Frosch

Also listed as: PB HLTH C202B

ESPM C255 Seminar in Sociology of Forest and Wildland Resources 3 Units
Individual projects and group discussions concerning social constraints to, and effects of, natural resource planning and management. Application of sociological theories to problems of managing wildland ecosystems. Students will examine topics of individual interest related to the management of wildland uses. Enrollment limited.
Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Fortmann

Also listed as: GEOG C250

ESPM 256 Science, Technology, and the Politics of Nature 3 Units
This course will introduce the methods and theories of Science and Technology Studies (STS) in order to explore the relationships among science, technology, law, and politics in the domains of environment and health. The course will focus some attention on the tension between technocracy and democracy in science policy, and on the role of biotechnology in reshaping the natural and political order. The course will equip graduate students in the social sciences, law, life sciences, and public policy with theoretical and practical tools for analyzing complex problems at the science, technology, and society interface.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Winickoff

ESPM 258 Race, Science, and Resource Policy 3 Units
This course addresses explantation and strategy in natural resource policy with an emphasis on whether, why, and how (a) 'race' distributes access to and control of environmental resources, (b) 'science' creates and arrays perceptions, organization and control of these resources, and (c) public policy shapes racial disparities in natural resource opportunities. Topics are drawn primarily from issues in metropolitan, agricultural, and public resource systems.
Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Romm

Formerly known as: 214

ESPM 259 Transnational Environmental Politics and Movements 3 Units
Contemporary issues in international environmental politics; impacts of globalization on the environment; comparative transnational environmental movements. Study of current and historical texts. Case studies drawn from around the world with a focus on methods and research techniques.
Rules & Requirements

Prerequisites: Upper division course in environmental policy or social science

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: O'Neill

ESPM 260 Governance of Global Production 3 Units
This course explores critical policy and theoretical questions in the governance of global production. Current trends in the restructuring of industrial production; distributions of environmental, labor, and social impacts from this production; and new strategies for democratic governance are analyzed, including corporate self-regulation, monitoring, certification and labeling, fair trade programs, legal strategies, and international accords and agreements.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: O'Rourke

ESPM 261 Sustainability and Society 3 Units
Science-based technologies that are central to the search for sustainability in contemporary societies and their environmental impacts. Theoretical approaches to investigating how science, technology, and environment intersect. How societies move closer to sustainable technological systems. Redesign of existing technologies and the introduction of new technologies. How adverse impacts can be prevented through policy. Case studies of contemporary developments.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Iles

ESPM 262 Race, Identity, and the Environment 3 Units
Advanced readings on environment and race. Shifting meanings of "race" and its application and usefulness in theorizing human-environment relationships. Foundations of environmental ideas and attitudes towards the natural environment and their connections to contemporary environmental practices. Construction of environmental narratives and images in defining ideas of racial and place identity. How representations of the natural environment are structurally and culturally racialized within environmental institutions and the media. Post-race possibilities.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Finney

ESPM 263 Indigenous, Feminist, and Postcolonial Approaches to Science, Technology, and Environment 4 Units
This seminar presents material from indigenous studies; feminist and postcolonial science and technology studies (STS), including animal studies; political ecology; and other fields. It engages non-dominant knowledges while interrogating the role of key technoscientific concepts (modernity, objectivity, universality) in colonizations of both humans and nonhumans. This course highlights the role of critical methods in shifting power relations in research, including students' own research.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: TallBear

ESPM 264 Silviculture Seminar 1 Unit
A seminar covering various aspects of silviculture and related issues.
Rules & Requirements

Prerequisites: 185 or consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: O'Hara

ESPM 265 Seminar on Fire as an Ecological Factor 2 Units
Effect of fire on ecology of forest and rangeland.
Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Stephens

ESPM 268 Seminar in Range Ecology 2 Units
A seminar course dealing with selected topics in ecology of rangelands.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

ESPM 271 Advanced Remote Sensing of Natural Resources 3 Units
Advanced photographic systems. Nonphotographic systems including multispectral scanner, imaging spectrometry, thermal, and RADAR. The use of ditigal image processing, geographic information systems (GIS,) and accuracy assessment. A look into linking remote sensing with GIS and integrated analysis of multisource spatial data. Laboratories and application projects are to be arranged.
Rules & Requirements

Prerequisites: 172, Statistics 20, or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Gong

ESPM C273 Science and Technology Studies Research Seminar 3 Units
This course will cover methods and approaches for students considering professionalizing in the field of STS, including a chance for students to workshop written work.
Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Also listed as: ANTHRO C273/HISTORY C251/STS C250

ESPM 276 Advanced Silviculture 2 Units
Advanced topics related to the dynamics and management of forest stands such as competition effects, mixed-species interactions, mutiaged stand silviculture, pruning, thinning regimes, management for old growth features, wood quality effects, and others. Field trips may be included.
Rules & Requirements

Prerequisites: 185 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: O'Hara

ESPM 277 Advanced Topics in Conservation Biology 3 Units
A graduate level seminar covering advanced topics in conservation of biodiversity, focused on designing protected area networks. We will first lay the groundwork for the course by exploring the fundamental papers in ecology and conservation biology that led to systematic conservation planning. Then, we will study various issues at the current frontiers of the discipline, such as incorporating threats, costs, evolutionary processes, and ecosystem services into reserve network design. The class will encourage student engagement through discussions, peer instruction and peer review of essays.
Rules & Requirements

Prerequisites: Undergraduate courses in ecology, population biology, or conservation biology

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Kremen

ESPM 278 Range Assessment 3 Units
Rangeland vegetation sampling techniques with emphasis on comparing the relative efficiency of different techniques of vegetation measurement. Includes weekly lab exercises on artificial sampling boards and/or in the field. Juniors and seniors are encouraged.
Rules & Requirements

Prerequisites: 186 and one semester of statistics

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Allen-Diaz

ESPM 279 Seminar on Pastoralism 3 Units
A survey of pastoral animal management and production systems, as they influence and are influenced by the rangeland environment. Review of the evolution of animal management practices; contemporary management systems in California,the West, and worldwide; and production systems with both traditional and nontraditional goals. Examination of agroforestry and nomadic and transhumant grazing systems, sheep and cattle production, game ranching, and organic meat production will be included.
Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Huntsinger

ESPM 280 Seminar in Range Ecosystem Planning and Policy 3 Units
A seminar course dealing with selected current topics in range ecosystem planning and policy.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Bartolome

ESPM 281 Seminar in Wildlife Biology and Management 2 Units
Reading, conference, and discussion. Reports and discussion of recent studies in wildlife biology and management. Open to qualified graduate students from other departments.
Rules & Requirements

Prerequisites: 114 and 187

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

ESPM C282 Health Implications of Climate Change 3 Units
The course will provide a basic foundation in the physical mechanisms of, responses to, and health implications of climate change. We will explore the variety of epidemiologic, risk assessment, and statistical methods used to understand the impacts of climate change on health across diverse demographic groups. The public health implications, positive and negative, of efforts to mitigate and adapt to climate change will be elaborated, including discussions of ethical, political, and economic aspects of these efforts. Students will be responsible for leading class discussions and presenting a poster on their choice of a topic related to climate change and health.
Rules & Requirements

Prerequisites: The material will be presented with minimal expectation of a background in physical science, although some additional reading may be needed for students with no university science courses. A background in epidemiology is also helpful, but not necessary

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructors: Jerrett, Morello-Frosch

Also listed as: PB HLTH C271G

ESPM 284 Demographic Methods for Population Viability Analysis 3 Units
Application of demographic methods to the management of plant and animal populations. Conservation problems faced by small populations of threatened or exploited species will be emphasized. Implications for life-history theory will also be discussed. Demographic analyses include (1) an understanding of life cycle diagrams, projection matrices, and age- and stage-based approaches; (2) calculation of population growth rate and sensitivity of demographic parameters to perturbation; and (3) advanced tehcniques of stochastic simulation modeling, spatial analyses, and population viability analyses will be learned.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

Instructor: Beissinger

ESPM 290 Special Topics in Environmental Science, Policy, and Management 1 - 4 Units
Study and critical analysis of topics, research, and texts pertinent to environmental science, policy, and management. Different topics will be available each semester reflecting faculty and student interest.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Letter grade.

ESPM 296 Individual Study 1 - 7 Units
Individual study in consultation with a member of the faculty directed to analysis and synthesis of the literature of a specialized subject area in forestry and resource management.
Rules & Requirements

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

Hours & Format

Fall and/or spring: 15 weeks - 1-7 hours of independent study per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

ESPM 298 Directed Group Study 1 - 6 Units
Advanced study of research topics which vary each semester.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

Fall and/or spring: 15 weeks - 4-24 hours of directed group study per week

Summer:
6 weeks - 10-60 hours of directed group study per week
8 weeks - 7.5-45 hours of directed group study per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: The grading option will be decided by the instructor when the class is offered.

ESPM 299 Individual Research 1 - 12 Units
Individual research under the supervision of a faculty member.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

ESPM N299 Individual Research 1 - 8 Units
Individual research under the supervision of a faculty member.
Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

Summer:
6 weeks - 2.5-20 hours of independent study per week
8 weeks - 1.5-15 hours of independent study per week
10 weeks - 1.5-12 hours of independent study per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Formerly known as: Entomological Sciences 299, Forestry and Resource Management 299, Plant Pathology 299, and Soil Science 299

ESPM 300 Supervised Teaching in Environmental Science, Policy, and Management 1 - 6 Units
Teaching methods at the University level; course content; problem set review and development; guidance of laboratory experiments; course development and evaluation; supervised practice teaching.
Rules & Requirements

Prerequisites: Consent of instructor and appointment as graduate student instructor

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/ Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

ESPM C302 Effective Scientific Communication 3 Units
This course will introduce methods of organizing and delivering oral presentations, initating and organizing manuscripts, and utilizing digital communication methods, such as web-based media. Students will develop effective communication techniques through in-class experience. This class will have an emphasis on the sciences but will be useful and open to graduate students of all disciplines.
Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/ Professional course for teachers or prospective teachers

Grading: Letter grade.

Instructors: Resh, Rhew

Also listed as: GEOG C302

ESPM 375 Professional Preparation: Teaching in Environmental Science, Policy, and Management 2 Units
The course will consist of readings and discussions led by instructors, graduate students, and guest speakers covering topics on developing teaching skills relevant to an interdisciplinary environmental science program. Students will present brief lectures that will be taped and evaluated and will learn skills for evaluating success in conveying complex ideas to their own students.
Hours & Format

Fall and/or spring: 15 weeks - 7.5 hours of lecture per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/ Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructors: Fairfax, Resh

Formerly known as: Environmental Science, Policy, and Management 301

ESPM 400 Professional Training in Research 1 - 6 Units
Training for students in planning and performing research under the supervision of a faculty member. This course is intended to provide credit for experience obtained.
Rules & Requirements

Prerequisites: Consent of instructor and appointment as graduate student researcher

Credit Restrictions: Course does not satisfy unit or residence requirements.

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

Hours & Format

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

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Other professional

Grading: Offered for satisfactory/unsatisfactory grade only.

ESPM 601 Individual Study for Master's Students 1 - 8 Units
Individual study for the comprehensive examination in consultation with the field adviser.
Rules & Requirements

Prerequisites: Consent of instructor

Credit Restrictions: Course does not satisfy unit or residence requirements for master's degree.

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

Hours & Format

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

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.

ESPM 602 Individual Study for Doctoral Students 1 - 8 Units
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: May not be used for residence requirements for the doctoral degree. Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

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

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Environ Sci, Policy, and Management/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.