

Approved GES Coupled Systems Courses

- **ANTH 328 Food Origins, Food Culture (3)** Lectures and discussion offer an anthropological introduction to how humans created and transformed food through time. Sophomore standing or higher. (Spring only) DS
- **ANTH 333 Climate Change and Cultural Response: Past, Present, and Future (3)** Climate change is a reality, yet there is much uncertainty about how it will affect our lives. Investigates cultural response to climate change, using studies of the past to plan for the future. (Alt. years: spring) (Cross-listed as SUST 333) DS *Sustainability Science Track (option, see Notes)
- **ANTH 338 Historical Ecology (3)** Examines the recursive relationship between humans and the environment across deep time. (Fall only) DS
- **ANTH 427 Food, Health, and Society (3)** How human groups identify, collect, create, and transform foods; how they shape those into dietary behaviors, and the influence of those behaviors on health. Pre: junior standing or higher or consent. DS
- **ANTH 415 Ecological Anthropology (3)** Relationship of humans with natural environment; role of culture in ecological systems. Pre: 152. DS
- **ANTH 459 Extinctions (3)** An extraordinary number of plants and animals have gone extinct. Delves deeply into the primary literature that focuses on extinction and conservation from the beginning of the earth to the present day. Pre: 215 or consent. (Alt. yrs: fall) DB
- **ANTH 482 Anthropology and the Environment: Culture, Power, and Politics (3)** Investigates environmental problems from an anthropological perspective, and examines the cultural politics of contestations over resources, rights, and the meanings of nature. Pre: 152 or 415 or consent. (Alt. years) DS
- **ASTR 210 Foundations of Astronomy^a (3)** A rigorous overview of modern astronomy: solar system, stellar, galactic and extragalactic astronomy and cosmology. For science and engineering students. Pre: PHYS 151 or PHYS 170. DP
- **ATMO 302 Atmospheric Physics (3)** Energy and thermodynamics, statics and stability, physical processes of cloud formation, radiation and Earth-atmosphere heat balance, kinetic theory, optical effects. Pre: 200, MATH 242, and PHYS 272; or consent. DP
- **ATMO 303 Introduction to Atmospheric Dynamics (3)** Scalar and vector development of basic laws of hydrodynamics, equations of motion, kinematics, divergence and vorticity, viscosity and turbulence, introduction to numerical weather prediction, general circulation. Pre: 302 and MATH 244. DP
- **ATMO 304 Global and Local Perspectives on Severe Weather (3)** Dynamics and structure of the main types of severe weather (tropical cyclones, supercell storms, tornadoes, flash floods, hailstorms, fog, etc.); future changes due to climate change; risk assessment; severe weather in Hawai'i. ATMO, GES, GG, GEO, GES, NREM, or OCN students only. A-F only. (Alt years: Spring) (Cross-listed as GES 304 and SUST 304) DP
- **ATMO 305 Meteorological Instruments and Observations (3)** (2 Lec, 1 3-hr Lab) Each week targets a different meteorological instrument and culminates in a lab exercise and report. The focus is on accurate measurement and scientific-style writing. A-F only. Pre: 302 and PHYS 272/272L DP
- **ATMO 320 Programming for Meteorologists (3)** Scientific programming in Fortran 77, graphics software and meteorological applications. A-F or Audit. Pre: 302 (or concurrent) and MATH 241; or consent.
- **ATMO 402 Applied Atmospheric Dynamics (3)** Advanced concepts in dynamics: vorticity, cyclogenesis, jet streams, fronts, mesoscale circulations. Pre: 303. DP
- **ATMO 405 Synoptic Satellite Meteorology (3)** (2 Lec, 1 3-hr Lab) Satellite applications to synoptic meteorology and forecasting, including orbital elements, ephemerides, viewing geometry, radiation, satellite sensors, and interpreting satellite data. Pre: 302. DP
- **ATMO 406 Tropical Meteorology (3)** History; tropical clouds and hydrometeors; typhoons; monsoons; local and diurnal effects. Pre: 303. DP
- **ATMO 449 Climate Modeling, Data Analysis and Applications (3)** Introduction to regional and global climate modeling for environmental scientists and engineers. Learn principles of climate modeling, how to access and use climate data for sustainable engineering and environmental management solutions, and effectively communicate results. Repeatable one time. ATMO, CEE, EARTH, GES, OCN, NREM majors only. Senior standing or higher, or consent. (Cross-listed as CEE 449 and SUST 449) *Sustainability Science Track (option, see Notes)
- **BIOC 241 Fundamentals of Biochemistry^a (3)** Biological chemistry stressing integration of concepts of general, inorganic, and biochemistry and application to life chemistry. Pre: beginning algebra and high school science. DP
- **BIOC 441 Basic Biochemistry (4)** Principles of biochemistry, applicable to medicine and real-life situations, involving metabolism of carbohydrates, lipids, proteins, nucleic acids, and vitamins. Taught by biomedical researchers. Evaluated based on exams, quizzes, homework, and group presentation. DB
- **BIOL 265 Ecology and Evolutionary Biology^a (3)** Principles of ecology and evolution for life science majors stressing integrated approach and recent advance. A-F only. Pre: C (not C-) or better in 171/171L, 172, 172L (or concurrent), and 265L (or concurrent). DB

- **BIOL 301 Marine Ecology and Evolution (3)** Functional, ecological, and evolutionary problems faced by life in the sea. Draws from major marine habitats and associated communities, from the deep sea to the plankton. Impacts of overfishing, marine pollution, and land development on the ecology and evolution of marine organisms. Emphasis on developing problem solving and quantitative skills. A-F only. Pre: C (not C-) or better in 265/265L, 301L (or concurrent), and OCN 201; or consent. **DB**
- **BIOL 310 Environmental Issues (3)** Global environmental problems in historical perspective; physical, biological, sociocultural views. Pre: one of 101, 123, or GEOG 101; or consent. **DB**
- **BIOL 340 Genetics, Evolution and Society (3)** The role of genetics in evolution, medicine, behavior, plant and animal breeding and technology; its impact on today's society. Not a BIOL major elective. Pre: one semester of biological science at college level or consent. (Cross-listed as CMB 351) **DB**
- **BIOL 360 Island Ecosystems (3)** Characteristics of island biota; examples from Hawai'i and the Pacific. Impact of island and continental cultures; policy and ecosystem endangerment; contemporary legislation, policy, and management practices. Pre: one semester of biological science or consent. Not a BIOL major elective. **DB**
- **BIOL 404 Advanced Topics in Marine Biology (3)** Current themes in marine biology and experience in scientific assessment. Repeatable two times. MBIO majors only. A-F only. Pre: C (not C-) or better in 301/301L or consent. **DB**
- **BIOL 410 Human Role in Environmental Change (3)** Human impacts through time on vegetation, animals, landforms, soils, climate, and atmosphere. Special reference to Asian/Pacific region. Implications of long-term environmental change for human habitability. Pre: with a minimum grade of B, one of 101, 123 or GEOG 101 and either 310 or GEOG 322; or consent. (Cross-listed as GEOG 410) **DB**
- **BIOL 411 Corals and Coral Reefs (3)** The biogeography, evolution, ecology, and physiology of corals and coral reefs, and the application of this information to the management of coral reefs. Emphasis will be placed on processes such as dispersal, the evolution and operation of mutualisms, calcification, reproduction, and the maintenance of diversity. Pre: BIOL 265 (or concurrent) or BIOL 301 (or concurrent). **(Spring only)**
- **BOT 350 Resource Management and Conservation in Hawai'i (3)** Management of native Hawaiian organisms and terrestrial ecosystems with particular attention to strategies, planning, research, and management actions necessary to control alien influences and promote native species. Pre: college general biology. **DB**
- **BOT 457 'Āina Mauliola: Hawaiian Ecosystems (3)** Comprehensive analysis of traditional Hawaiian and modern resource management practices. Rigorous overview of the dominant physical and biological processes from the uplands to the oceans in Hawai'i. Pre: 105 or 107, HWST 107, and junior standing; or consent. (Cross-listed as HWST 457 and SUST 457) ***Sustainability Science Track (option, see Notes)**
- **BOT 458 Natural Resource Issues and Ethics (4)** Overview of the history of land, resources and power in Hawai'i; players and processes influencing land and natural resources policies today explored from Native Hawaiian and other viewpoints. Extensive use of case studies. Pre: 457/HWST/SUST 457. (Cross-listed as HWST 458)
- **BOT 459 Strategies in Hawaiian Resource Use (3)** Analyzing diverse land and water use strategies of O'ahu, from traditional Hawaiian, scientific and economic perspectives, through classroom and on-site lectures. Topics include traditional Hawaiian methods, modern development, threatened ecosystems, ecotourism and scientific research. A-F only. Pre: BOT/HWST/SUST 457 (or concurrent) or consent. (Cross-listed as HWST 459)
- **BOT 460 Hui Konoiki Internship: Applied Resource Management (3)** A "hands-on" internship in an environmental or resource-management organization in Hawai'i. The experience will be broadened and supplemented by classroom lectures, discussion and analysis from traditional Hawaiian, scientific and economic perspectives. A-F only. Pre: BOT/HWST/SUST 457, BOT/HWST 458 (or co-requisite), BOT/HWST 459; or consent. **(Spring only)** (Cross-listed as HWST 460 and SUST 460) ***Sustainability Science Track (option, see Notes)**
- **BOT 480 Algal Diversity and Evolution (4)** (3 Lec, 1 3-hr Lab) Principles of algal diversity, structure, and evolution. Identification of common Hawaiian algae. Pre: one of 101, BIOL 172, MICR 351, ZOOL 101; or consent. **DB DY**
- **BUS 314 Business Finance (3)** Introduction to the theory and practice of financial management: analysis and decision making for asset management, capital budgeting, capital structure, and dividend policy. Prerequisite for all other finance courses. Pre: ACC 200 and ACC 210, ECON 130 and ECON 131; or consent. **†BAM MSF only**
- **CHEM 272 Organic Chemistry I^a (3)** Molecular structure, stereochemistry, spectroscopy, mechanisms, reactions, and synthesis of organic compounds. Pre: C (not C-) or better in 162 or 171 or 181A. **DP**
- **CHEM 273 Organic Chemistry II^a (3)** Continuation of 272. Molecular structure, stereochemistry, spectroscopy, mechanisms, reactions, and synthesis of organic compounds. Pre: C (not C-) or better in 272. **DP**
- **CMB 351 Genetics, Evolution and Society (3)** The role of genetics in evolution, medicine, behavior, plant and animal breeding and technology; its impact on today's society. Pre: one semester of biological science at college level or consent. Not a BIOL major elective. (Cross-listed as BIOL 340) **DB**
- **ECON 332 Economics of Global Climate Change (3)** Nature and causes of global climate change and economic solutions. Topics include valuing climate change impacts, energy solutions, environmental implications, societal adaptation, and international

cooperation. A-F only. Pre: 120 or 130 or 131, or consent. (Once a year) (Cross-listed as SUST 332) **DS *Sustainability Science Track (option, see Notes)**

- **ECON 358 Environmental Economics (3)** Nature and causes of environmental degradation/economic solutions, with emphasis on relevant ethical issues and decision-making. Topics include air and water pollution, toxic waste, deforestation, soil erosion, biodiversity, global warming, and sustainable development. Pre: 120, 130, or 131; or consent. **DS**
- **ECON 458 Project Evaluation and Resource Management (3)** Principles of project evaluation and policy analysis. Shadow pricing, economic cost of taxes and tariffs; public policy for exhaustible, renewable, and environmental resources. Pre: 301. (Cross-listed as SUST 458) **DS *Sustainability Science Track (option, see Notes)**
- **EPET 301 Space Science and Instrumentation (4)** Essential techniques for remote compositional analysis of planets; understanding spectroscopy, mineralogy, and geochemistry of planetary surfaces and their measurement. Design of space flight instrumentation. A-F only. Pre: 201, or EARTH 101 and EARTH 101L and EARTH 105, or EARTH 101 and EARTH 107; and CHEM 161 and PHYS 272. (Fall only)
- **EPET 302 Space Mission Design (4)** Will cover all aspects of spacecraft design, subsystems, science payload, systems engineering, project management, and budgets that are important to producing a fully successful mission. A-F only. Pre: 301. (Spring only)
- **ERTH 300 Volcanology (3)** Volcanic eruptions and their consequences. Includes models for volcanic eruptions including explosive eruptions and lava flows, monitoring of active volcanoes, evaluation and impacts of volcanic hazards, and mitigation of volcanic risk. Field trips. Normally fall. EARTH and GEOL majors or consent. Pre: 200 or consent. **DP**
- **ERTH 301 Mineralogy (4)** (3 Lec, 1 3-hr Lab) Crystallography, crystal chemistry, phase equilibria, and crystal structures. Also covers mineral optics and identification and includes an introduction to modern methods of mineralogy and crystallography. Pre: 200 and (CHEM 162/162L or CHEM 171/171L). or consent. **DP DY**
- **ERTH 302 Igneous and Metamorphic Petrology (3)** (2 Lec, 1 3-hr Lab) Survey of composition, classification, and occurrence of igneous and metamorphic rocks. Hand-specimen identification and optical petrography of igneous and metamorphic rocks. Development of critical thinking and writing skills. Pre: 301 or consent. **DP**
- **ERTH 303 Structural Geology (3)** (2 Lec, 1 3-hr Lab) Introduction to (a) the geometry, kinematics, and mechanics of crustal deformation, and (b) continuum mechanics in geology. Develops skills in three-dimensional thinking through geologic maps, cross sections, various projections, experiments, and vector analyses. Pre: 200, 250, MATH 241 or MATH 251A, and PHYS 151 or PHYS 170; or consent. **DP**
- **ERTH 304 Physics of Earth and Planets (4)** (3 Lec, 1 3-hr Lab) Essentials of geophysics: formation of Solar System and Earth, gravity, seismology, heat flow, geomagnetism, isostasy, plate tectonics. Course work involves application of basic physics to understanding Earth structure. Labs include field surveys and computer analyses. Pre: 250, 303, MATH 241, MATH 242, and PHYS 272; or consent. **DP DY**
- **ERTH 305 Geological Field Methods (3)** Methods used in geological investigations in the field. Eight hours on Saturday in the field. Pre: 302, 303, and 309; or consent. **DP**
- **ERTH 306 Work of Water (3)** Physical properties of water, geological aspects of surface water and ground water occurrence, surface water and groundwater resources, use, and problems. Pre: 200 or consent. (Alt. years: fall) **DP DY**
- **ERTH 309 Sedimentology and Stratigraphy (4)** (3 Lec, 1 3-hr Lab) Principles of sedimentology, sedimentary petrology, geochemistry and stratigraphy. Description and discussion of modern and past processes and environments that form sedimentary rocks, properties of sedimentary rocks and interpretation of these properties and stratigraphic relationships in terms of Earth history. Repeatable one time. Pre: 200 or consent. (Spring only) **DP DY**
- **ERTH 325 Geochemistry (3)** Theory and applications of chemical principles and chemical analysis to Earth, ocean and environmental sciences; chemistry of hydrosphere-geosphere-biosphere system, origin/differentiation of Earth/Solar system, volcanic processes, natural radioactivity, organic/inorganic chemistry. Pre: 200, 250, MATH 241 or MATH 251A, CHEM 162 (or concurrent); or consent. (Fall only) **DP**
- **ERTH 333 Earth Materials and Structures (3)** (2 Lec, 1 3-hr Lab) Lecture and lab that covers formation, occurrence, and identification of common minerals, rocks, and geologic structures. Lab work will include study of hands-samples, thin-sections, and field experiences. A-F only. Pre: 200. (Fall only) **DP DY**
- **ERTH 401 Introduction to Mineral Physics (3)** Scientific study of the materials that make up the Earth. Properties of minerals on micro- and macro-scales; their properties and behavior. Pre: 302 and PHYS 272, or consent. (Alt. years) **DP**
- **ERTH 402 Hawaiian Geology (3)** Consists of lectures, discussions, and field trips about the geology of the Hawaiian islands. Focus on geological processes and the geologic history of all islands will be covered. Pre: 302 and 303; or consent. **DP**
- **ERTH 404 Remote Compositional Analysis: Spectroscopy, Mineralogy, and Geochemistry of Planetary Surfaces (4)** Essential techniques for remote compositional analysis of planets; understanding spectroscopy, mineralogy, and geochemistry of planetary surfaces. Comparative studies of fundamental planetary science phenomena. Planetary surface science discoveries. Sustainability of planetary environments. Repeatable one time. Pre: (101 or 105 or 107 or ASTR 150; and CHEM 161; and MATH 241 and 242 and PHYS 272) with a minimum grade of C+; or consent.

- **ERTH 406 Natural Disasters: Geoethics and the Layman (3)** Evaluates ethical practice of geoscience as it relates to studies of natural disasters that result from geological and meteorological phenomena and the means that earth scientists interact with the laymen. Pre: 101, 103, 104, or 170. (Once a year)
- **ERTH 407 Energy and Mineral Resources (3)** Lecture and discussion on the origin, distribution and exploitation of fossil fuels, renewable energy resources and ore deposits. Coverage and detail will depend partly on student interest and background. Pre: consent. **DP**
- **ERTH 413 Introduction to Statistics and Data Analysis (3)** Exploratory data analysis, error propagation, probability theory and statistics, curve fitting, regression, sequence and spectral analysis, multivariate analysis, and analysis of directional data. Pre: 250 and MATH 242 (or concurrent) or consent.
- **ERTH 420 Beaches, Reefs, and Climate Change (3)** Global and local aspects of climate change and paleoclimate; beach and reef processes and response to climate change; management of coastal environments; field study local sites. Repeatable one time. Junior standing or higher, or consent. (Cross-listed as SUST 427) **DP *Sustainability Science Track (option, see Notes)**
- **ERTH 423 Environmental Geochemistry (3)** Sediments, structure, geophysics, geochemistry, history of ocean basins and margins. Pre: 200 and 302 or consent. (Cross-listed as OCN 423) **DP**
- **ERTH 425 Environmental Geochemistry (3)** Theory and applications of contaminant/pollutant distribution in the hydrosphere-geosphere-biosphere-atmosphere system, remediation methods, prevention, industrial/agricultural best practices. Topics include aqueous geochemistry, organic, inorganic, gas phase, and ecosystem impacts of environmental contaminants. Pre: CHEM 161 and CHEM 162, or consent. (Spring only) (Cross-listed as SUST 425) **DP *Sustainability Science Track (option, see Notes)**
- **ERTH 444 Plate Tectonics (3)** (2 Lec, 1 3-hr Lab) Quantitative geometrical analysis techniques of plate tectonics theory; instantaneous and finite rotation poles; triple-junction analysis; plate boundary stresses. Pre: 200 or consent. (Alt. years) (Cross-listed as OCN 444) **DP**
- **ERTH 450 Geophysical Methods (4)** Combined lecture/lab covering basic geophysical theories, exploration, and interpretation. Seismic reflection and refraction, gravity, and electromagnetics. Constraints on models of Earth's internal structure and composition. Pre: 250, 303, MATH 241, MATH 242, and PHYS 272; or consent. **DP DY**
- **ERTH 451 Earthquakes and Crustal Deformation (3)** Earthquakes and crustal deformation through modern seismological and geodetic observations; elastic properties of rocks, seismic waves, causes, detection, and location of earthquakes; crustal motions of the earthquake cycle; tsunami generation, liquefaction, and planetary observations. Pre: MATH 241 and PHYS 170, or consent. (Alt. years) **DP**
- **ERTH 454 Engineering Geology (3)** Solutions of geotechnical problems by geologists and engineers through recognition, characterization, evaluation, and assessment of geologic processes that impact people, engineering structures, and engineering operations. Group format. EARTH, GEOL, and CEE majors only. Junior standing and higher. Pre: consent. (Spring only)
- **ERTH 455 Hydrogeology (4)** (3 Lec, 1 3-hr Lab) Occurrence, characteristics, movement, quality, development, and contamination of water in the Earth's crust. **DP**
- **ERTH 460 Geological Remote Sensing (4)** (3 Lec, 1 3-hr Lab) Combined lecture-lab on the concepts behind, geologic uses for, and techniques of satellite and airborne remote sensing. Lab work will consist of computer image processing. Field trips. Open to non-majors. Pre: 200 or consent. (Spring only) **DP**
- **ERTH 461 Geospatial Information (3)** Combined lecture/lab covering the collection, analysis and use of geospatially registered field data. Pre: 200 (or equivalent). (Alt. years)
- **ERTH 466 Planetary Geology (3)** Comparative geology of the terrestrial planets (moon, Mars, Mercury, Venus, and Earth); impact cratering, volcanism, tectonism, geomorphology, weathering; manned and unmanned space exploration. Pre: any 100-level EARTH course. **DP**
- **ES 308 Race, Indigeneity, and Environmental Justice (3)** Introduction to environmental justice, explores the premise that all people have a right to a life-affirming environment. Will examine environmental racism, and the geographical dimensions of race and indigeneity. Pre: one DS or DH course, or consent. (Cross-listed as SUST 318) **DS *Sustainability Science Track (option, see Notes)**
- **FIN 301 Personal Finance (3)** Focuses on principles and techniques for handling personal financial decisions, including: personal budgeting, obtaining credit, life and casualty insurance, buying a home, buying an automobile, savings and investments, and retirement planning. **†BAM MSF only**
- **FIN 450 Enterprise Risk Management (3)** Overview analyzing various primary risks faced by corporations and developing important risk management techniques with an emphasis on enterprise risk management. Combined lectures, case studies, and discussions. BUS majors only. A-F only. Pre: BUS 314 or consent. (Once a year) **†BAM MSF only**
- **FIN 625 International Monetary Systems and Global Financial Markets (3)** Supply and demand for capital in national and international markets. Nature of capital movements and role of capital in industrialization of regions and nations. **†BAM MSF only**
- **FIN 633 Problems in Business Finance (3)** Application of financial principles and analytical techniques to financial problems. Case method. Pre: BUS 629 or consent. **†BAM MSF only**

- **FIN 639 International Banking (3)** Commercial, investment, and merchant banking in the international arena. Includes international lending, Euromarkets, global gap management, Forex activities, and international risk management. Pre: BUS 629 or consent. †**BAM MSF only**
- **GEO 300 Introduction to Climatology (3)** Elements and controls of climate. World patterns of insolation, temperature, evaporation, precipitation, atmospheric circulation. Climatic classifications. Pre: 101 or ATMO 101 or ATMO 200, or consent. **DP**
- **GEO 302 Global Environmental Issues (3)** Use and abuse of natural resources and humanity's progress toward developing a sustainable relationship with its supporting environment. A-F only. **(Once a year)** (Cross-listed as SUST 314) ***Sustainability Science Track (option, see Notes)**
- **GEO 310 Introduction to Planning (3)** Perspectives on planning; planning tools and methods; specific Hawai'i planning–research problems from a multidisciplinary approach. Pre: junior standing or consent. (Cross-listed as PLAN 310) **DS**
- **GEO 322 Globalization and Environment (3)** Debates on globalization and development, population and resources; root causes of environmental degradation; impacts of globalization on environmentalism and environmental change; social approaches to managing environmental change. Pre: 102, 151, or consent. **(Once a year) DS**
- **GEO 324 Geography of Global Tourism (3)** Tourist landscape in relation to resources, spatial patterns of supply and demand, impacts of tourism development, and models of tourist space. Flows between major world regions. Pre: sophomore standing or higher, or consent. (Cross-listed as TIM 324) **DS**
- **GEO 330 Culture and Environment (3)** Introduction to cultural geography, the cultural landscape, and perceptions of the environment across different cultures. Pre: 102 or 151, or consent. **DS**
- **GEO 388 Introduction to GIS (3)** Design, implementation, and use. Database construction and documentation. Techniques for spatial data manipulation and display. Evaluation of existing systems. Student research projects. Pre: 104 or consent.
- **GEO 401 Climate Change (3)** Approaches to the study of past and future climate change. Pre: 101 or 300 or 401 or 402 or 405 or ATMO 101 or ATMO 200 or ATMO 302 or ATMO 303 or ATMO 310, or consent. **DP**
- **GEO 402 Agricultural Climatology (3)** Analyzing climatic data; relation to photosynthesis, phenological development, and crop yields. Crop-weather models as guides to improved land-use planning and agronomic practices. Pre: 101 or 300 or 400 or 401 or 405 or ATMO 101 or ATMO 200 or ATMO 302 or ATMO 303 or ATMO 310, or consent. **DP**
- **GEO 404 Atmospheric Pollution (3)** Examination of air quality problems from scientific and policy perspectives. Includes case studies that explore economic, political, technical, and legal aspects of pollution control. Pre: junior standing or higher, or consent. **DS**
- **GEO 405 Water in the Environment (3)** Water fluxes in the environment. Occurrence and movement of water; methods of quantification. Water balance of soil-plant system: precipitation, interception, infiltration, runoff, soil moisture, evapotranspiration, and groundwater recharge. Pre: 101 or 300 or 400 or 401 or 402 or ATMO 101 or ATMO 200 or ATMO 302 or ATMO 303 or ATMO 310, or consent. **DP**
- **GEO 410 Human Role in Environmental Change (3)** Human impacts through time on vegetation, animals, landforms, soils, climate, and atmosphere. Special reference to Asian/Pacific region. Implications of long-term environmental change for human habitability. Pre: with a minimum grade of B, one of 101, BIOL 101, BIOL 123 and either 322 or BIOL 310; or consent. (Cross-listed as BIOL 410) **DB**
- **GEO 411 Past Global Change and the Human Era (3)** Study of past environments to understand present and future global change. Focus on terrestrial Quaternary environments and global processes. Pre: junior standing or higher, or consent. **DP**
- **GEO 412 Environmental Impact Assessment (3)** Introduction to analytical methods for identifying, measuring, and quantifying the impacts of changes or interventions in resource, human-environment, and other geographic systems. Pre: junior standing or higher, or consent. **(Alt. years)** (Cross-listed as PLAN 412)
- **GEO 413 Resource Management (3)** Management of land, water resources, coastal fisheries, forests and agriculture. Focus on problems facing Hawai'i and the Pacific. A-F only. Pre: junior standing or higher. **DS**
- **GEO 414 Environmental Hazards and Community Resilience (3)** Investigation of the forces behind natural and technological hazards, and human actions that reduce or increase vulnerability to natural disasters. Junior standing or higher. (Cross-listed as PLAN 414)
- **GEO 415 Nature-Based Tourism Management (3)** Principles of nature-based tourism, including a survey of impacts, objectives, planning, and management systems. Junior standing or higher. Pre: 324/TIM 324 or TIM 101. (Cross-listed as TIM 415 and SUST 415) **DS *Sustainability Science Track (option, see Notes)**
- **GES 304 Global and Local Perspectives on Severe Weather (3)** Dynamics and structure of the main types of severe weather (tropical cyclones, supercell storms, tornadoes, flash floods, hailstorms, fog, etc.); future changes due to climate change; risk assessment; severe weather in Hawai'i. ATMO, GES, GG, GEO, GES, NREM, or OCN students only. A-F only. **(Alt years: Spring)** (Cross-listed as ATMO 304 and SUST 304) **DP *Sustainability Science Track (option, see Notes)**
- **GES 454 Earth's Microbiome (3)** A lecture course on the diversity and function of the Earth's microbiomes inclusive of terrestrial and aquatic ecosystems, symbiotic and free living microorganism with a focus on the microbial underpinnings of the Earth's

biogeochemistry. A-F only. Pre: OCN 102 or OCN 201 or BOT 305 or BIOL 305, or BIOL 171 and BIOL 172. (Cross-listed as OCN 454)

- **HWST 457 'Āina Mauliolo: Hawaiian Ecosystems (3)** Comprehensive analysis of traditional Hawaiian and modern resource management practices. Rigorous overview of the dominant physical and biological processes from the uplands to the oceans in Hawai'i. Pre: 107, BOT 105 or 107, and junior standing; or consent. (Cross-listed as BOT 457 and SUST 457) ***Sustainability Science Track (option, see Notes)**
- **HWST 458 Natural Resource Issues and Ethics (4)** Overview of the history of land, resources and power in Hawai'i; players and processes influencing land and natural resources policies today explored from Native Hawaiian and other viewpoints. Extensive use of case studies. Pre: 457/BOT/SUST 457. (Cross-listed as BOT 458)
- **HWST 459 Strategies in Hawaiian Resource Use (3)** Analyzing diverse land and water use strategies of O'ahu, from traditional Hawaiian, scientific and economic perspectives, through classroom and on-site lectures. Topics include traditional Hawaiian methods, modern development, threatened ecosystems, ecotourism and scientific research. A-F only. Pre: 457 /BOT/SUST 457 (or concurrent), or consent. (Cross-listed as BOT 459)
- **HWST 460 Hui Konohiki Practicum (3)** A "hands-on" internship in an environmental or resource-management organization in Hawai'i. The experience will be broadened and supplemented by classroom lectures, discussion and analysis from traditional Hawaiian, scientific and economic perspectives. A-F only. Pre: 457/BOT/SUST 457, 458/BOT 458 (or co-requisite), 459/BOT 459; or consent. **(Spring only)** (Cross-listed as BOT 460 and SUST 460) ***Sustainability Science Track (option, see Notes)**
- **INS 300 Principles of Insurance (3)** Risk management and insurance application to business and personal financial decision-making. Introduction to basic risk management concepts and techniques. Analyze various types of insurance: including life, property, casualty, liability, health, disability, and long-term care. **†BAM MSF only**
- **MBBE 412 Environmental Biochemistry (3)** Biochemical and chemical principles of occurrence, distribution, biotic and abiotic conversion, fate, and impact of synthetic and natural molecules in the environment. Important pollutants will be used as case studies to illustrate the principles. A-F only. Pre: CHEM 152 or CHEM 272, and CHEM 162 or CHEM 171; or consent. **DB**
- **MICR 401 Marine Microbiology (3)** Evolution, ecology, biochemistry, genetics and physiology of marine bacteria by examining defined systems and organisms. Pre: BIOL 265/265L and BIOL 275/275L and BIOL 301 (or concurrent)/301L (or concurrent), and OCN 201; or 351/351L; or consent. **DB**
- **NREM 301 Natural Resources Management (3)** Biological and physical science aspects of natural resource management at local, national, and global scales. Topics covered include resource management of soil, water, forests, wetlands, coasts and wildlife. A-F only. Pre: NREM/TPSS 251 or 210; CHEM 151 or higher; and BIOL 172; or consent. **(Spring only)** (Cross-listed as SUST 311) **DB *Sustainability Science Track (option, see Notes)**
- **NREM 302 Natural Resource and Environmental Policy (3)** Introduction to American government policy in natural resources and environmental protection at federal, Hawai'i state and county levels. Policy principles, legal structure, governmental agencies, major statutes and programs, analytical techniques, program assessments. A-F only. Pre: NREM/PEPS/SUT 210 or (BIOL 101 or higher) or GEOG 101 or (ERTH 101 or higher); and 220/SUST 220 or one ECON course or two DS courses. (Cross-listed as SUST 312) **DS *Sustainability Science Track (option, see Notes)**
- **NREM 304 Fundamentals of Soil Science (3)** Origin, development, properties, management of tropical soils; classification of Hawaiian soils. A-F only. Minimum prerequisite grade of C or consent. Pre: CHEM 161 and 161L, or consent. Co-requisite: 304L. **(Fall only)** (Cross-listed as TPSS 304) **DP**
- **NREM 450 Wildlife Ecology and Management (3)** Lecture-based overview of the history, ecology, and management of wildlife species from around the world and Hawai'i. Pre: BIOL 172 or consent. **(Fall only)** (Cross-listed as SUST 451) ***Sustainability Science Track (option, see Notes)**
- **NREM 461 Soil and Water Conservation (3)** Past and present issues in soil and water conservation will be examined. Principles of erosion, conservation tillage, irrigation, and drainage will be discussed. Land-based threats to coastal zones and watershed management will also be covered. Pre: 301/SUST 311 or 304. **DP**
- **OCN 318 Introduction to Environmental Monitoring Systems and Measurements (3)** Introduction to environmental monitoring systems for earth science students. Students will learn how to construct, program, and deploy simple environmental monitoring systems to collect in-situ environmental data. OCN, EARTH, ATMO majors only. A-F only. Pre: 201/201L or EARTH 101/101L, CHEM 161/161L, and MATH 241; or consent. **(Fall only)**
- **OCN 321 Applied Principles of Environmental & Energy Policy (3)** Introduction to the methods and techniques of environmental and energy policy in relation to energy systems. Analysis of enacted policies from case studies to understanding the effectiveness, challenges, contradictions, and limitations of each. A-F only. Pre: any 100 or 200 level OCN course, or consent. Junior standing or higher. (Cross-listed as PPC 340 and SUST 323) ***Sustainability Science Track (option, see Notes)**
- **OCN 330 Mineral and Energy Resources of the Sea (3)** Hard mineral and petroleum origins, exploration, and exploitation. Renewable and non-renewable resources distribution. Political and scientific constraints. Pre: 201, ORE 202; or consent. (Cross-listed as ORE 330) **DP**
- **OCN 331 Living Resources of the Sea-Mai ke Kai Mai ke Ola (3)** Marine fisheries, aquaculture, and law of the sea. Principles of management of renewable resources. Political and scientific constraints and limitations. Sophomore standing or higher. **DB**

- **OCN 340 Ecology of Infectious Diseases and Symbioses (3)** Introduction to the ecology of infectious diseases of animals, plants, and humans. Factors affecting disease transmission and virulence. Effects of human activities and environmental change on disease transmission. Emphasis on issues pertinent to Hawai'i. A-F only. Pre: BIOL 171 and BIOL 172; or consent. **(Spring only)** (Cross-listed as PEPS 340)
- **OCN 403 Marine Functional Ecology and Biotechnology (3)** Marine functional genomics, biodiversity of marine natural habitats, marine microbial communities and their ecological functions, interactions of marine microbes and their host, climate change and marine biodiversity, marine biotechnology. A-F only. Pre: 201 or MICR 130, or consent. **(Spring only)** (Cross-listed as MBBE 405)
- **OCN 411 The Ethics of Climate Change and Geoengineering (3)** Provide a scientific basis to examine the consequences of climate change and the proposed geoengineering solutions, and examine the fundamental ethical basis that underlies environmental policy. A-F only. Pre: 310, or consent. **(Spring only. Alternate years.)** (Cross-listed as SUST 411) ***Sustainability Science Track (option, see Notes)**
- **OCN 418 Advanced Environmental Monitoring Systems and Measurements (3)** Builds upon 318 using more advanced microprocessors and environmental sensors, 3D printing, programming, etc. to construct, program, and deploy environmental monitoring systems to collect and stream in-situ time-series environmental measurements. OCN, EARTH, ATMO majors only. A-F only. Pre: 318, MATH 242, PHYS 272/272L, and CHEM 162/162L; or consent. **(Fall only)**
- **OCN 423 Marine Geology (3)** Sediments, structure, geophysics, geochemistry, history of ocean basins and margins. Pre: EARTH 200 and EARTH 302, or consent. (Cross-listed as EARTH 423) **DP**
- **OCN 430 Introduction to Deep-Sea Biology (3)** (1.5 Lec, 1.5 Discussion) Biology and ecology of deep-sea organisms and communities. Topics including benthic-pelagic coupling, depth zonation, energetics, diversity, adaptations, hydrothermal vents, seamounts, abyssal plains, deep-sea resource extraction and global climate change. A-F only. Pre: 201 and BIOL 265, or consent. **(Alt. years)**
- **OCN 435 Climate Change and Urbanization (3)** The following topics will be addressed: How are cities impacted by, and impacting climate change? How do urbanization, alteration of atmospheric processes, and extreme weather events affect urban systems and populations? A-F only. Pre: 363 or consent. **(Fall only)**
- **OCN 441 Principles of Sustainability Analysis (3)** Introduction to the principles of sustainability analysis through execution of Life Cycle Analysis applied to products, processes, or systems. LCA and the evaluation of environmental impact will be presented. Personal computer or laptop (Word 97 or higher) OS, and minimum of 4GB RAM. Repeatable one time. Junior standing or higher. A-F only. Pre: (CHEM 161 and PHYS 170) with a minimum grade of C-; or consent. **(Fall only)** (Cross-listed as CEE 441 and SUST 441) ***Sustainability Science Track (option, see Notes)**
- **OCN 442 Principles of Environmental Management Systems (3)** Introduction to the process of developing Environmental Management Systems that address the principles outlined in ISO14001:2015. Repeatable one time. Junior standing or higher. A-F only. **(Spring only)** (Cross-listed as SUST 442 and TIM 462) ***Sustainability Science Track (option, see Notes)**
- **OCN 454 Earth's Microbiome (3)** A lecture course on the diversity and function of the Earth's microbiomes inclusive of terrestrial and aquatic ecosystems, symbiotic and free living microorganism with a focus on the microbial underpinnings of the Earth's biogeochemistry. A-F only. Pre: OCN 102 or OCN 201 or BOT 305 or BIOL 305, or BIOL 171 and BIOL 172. (Cross-listed as GES 454)
- **OCN 457 Ridge to Reef: Coastal Ecosystem Ecology and Connectivity (3)** Watershed and coastal biogeochemistry/ecosystem science. Emphasis on field surveying and sampling of stream and reef habitats; laboratory chemical/biological analyses. Analysis of land use impacts on ecosystem health and ahupua'a resource management. A-F only. Pre: 201/201L, 310; or consent.
- **OCN 480 Dynamics of Marine Ecosystems: Biological-Physical Interactions in the Oceans (3)** Combined lecture and discussion examining biological and physical interactions in the oceans and their impacts on the functioning of marine ecosystems. GES majors only. A-F only. Pre: 201/201L, 310/310L, and PHYS 272/272L; or consent. **(Alt. years)**
- **OCN 481 Introduction to Ocean Ecosystem Modeling (3)** Introduction to modeling biogeochemical and physical oceanic processes by building a coupled model of the Pacific to investigate physical effects on plankton blooms. Students learn ecosystem dynamics, basic numerical methods, and programming. A-F only. GES majors only. Pre: 310 or PHYS 272, and OCN/ERTH 312 (with a minimum grade of B-). **(Spring only)**
- **PH 201 Introduction to Public Health (3)** Introduces public health concepts with an emphasis on principles and tools for population health, disease prevention, health professions and healthcare systems, and public health professions and systems. A-F only. **DS *Environmental Health Sciences Track**
- **PH 310 Introduction to Epidemiology (3)** Lecture/discussion on the fundamental principles of epidemiology, exploring patterns of disease, threats to health and EPI methods for prevention, control, and treatment. PH majors only. A-F only. Pre: 201, and 210 or MATH 140 or MATH 161 or higher. ***Environmental Health Sciences Track †BAM MPH**
- **PH 340 Public Health and the Environment (3)** Examines a variety of issues associated with environmental effects on disease incidence, morbidity, and mortality in relation to public health prevention strategies. Sophomore standing and above. ***Environmental Health Sciences Track**
- **PH 341 Public Health Biology and Pathophysiology (3)** Explores the biological basis of human disease and the role public health measures play in reducing both the extent and impact of chronic and acute diseases on individuals and society. A-F only.

Junior standing or higher. Pre: 201, and one of the following: BIOL 101 or BIOL 171 or BIOL 172 or PHYL 103 or PHYL 141 or FSHN 185. **DB** **Environmental Health Sciences Track*

- **PH 655 Biostatistics I (3)** Introduction to statistical methods for public health sciences. Probability, experimental design, t tests and analysis of variance, 2X2 contingency tables, linear regression, introduction to life tables. *†BAM MPH only*
- **PH 663 Principles of Epidemiology I (3)** Introduction to epidemiologic principles and methods. Topics covered include: outbreak investigation, measures of morbidity and mortality, measurements of risk, biological variability, screening, measurements of error, sampling, statistical significance, study design, and association and causation. *†BAM MPH only*
- **PH 664 Principles of Epidemiology II (3)** Lecture/discussion on: design and interpretation of experimental and observational studies; causation and casual inference; biases in study design; random error and statistics role in epidemiology; and epidemiological data analysis. A-F only. Pre: 655 and 663, or consent. *†BAM MPH only*
- **PHIL 316 Science, Technology, and Society (3)** Investigation of some of the complex interconnections between science, technology, and society. Pre: any course 100 or above in PHIL or in a course with either DB or DP or DS designation, or consent. **DH**
- **PEPS 310 Environment and Agriculture (3)** Overview of environmental issues and impacts associated with agriculture, specifically pest management issues, and options for environmentally responsible management and amelioration of these impacts. (Cross-listed as SUST 320) **Sustainability Science Track (option, see Notes)*
- **PEPS 451 Environmental Law (3)** Exploration of federal laws, regulations, and precedents that govern our interaction with the environment. Analysis of laws regulating air, water, toxins, pests, endangered species, and environmental justice. Pre: junior or senior standing.
- **PLAN 310 Introduction to Planning (3)** Perspectives on planning; planning tools and methods; specific Hawai'i planning–research problems from a multidisciplinary approach. Pre: junior standing or consent. (Cross-listed as GEOG 310) **DS** **Environmental Planning Track †BAM MURP*
- **PLAN 414 Environmental Hazards and Community Resilience (3)** Investigation of the forces behind natural and technological hazards, and human actions that reduce or increase vulnerability to natural disasters. Junior standing or higher. (Cross-listed as GEOG 414) **Environmental Planning Track*
- **PLAN 473 GIS for Community Planning (3)** Exploration of geographic information systems (GIS) area analysis techniques for spatial information management in community planning. Students will learn the basic concepts and principles, and practical skills of GIS through lectures, discussions, and labs. Repeatable one time. Junior standing or higher. **Environmental Planning Track †BAM MURP*
- **PLAN 600 Public Policy and Planning Theory (3)** Designed to a) impart a historic and comparative perspective on the evolution of urban and regional planning in public policy; b) explore the spatial and built environment dimensions of society, planning and policy; c) assess the justifications for planning and differing processes of planning in the U.S. and Asia-Pacific with a focus on the role of the planner in policy formulation and implementation. Graduate students only or with permission. A-F only. Repeatable two times. *†BAM MURP only*
- **PLAN 620 Environmental Planning and Policy (3)** Overview of urbanization and environmental change. An examination of environmental laws, policies, planning and urban design strategies designed to minimize and mitigate urban impacts. Repeatable one time. A-F only. (Cross-listed as SUST 620) **Environmental Planning Track †BAM MURP only*
- **POLS 315 Global Politics/International Relations (3)** Introduction to global politics with emphasis on concepts and theories developed from an international relations perspective. Pre: sophomore standing or higher, or consent. **DS**
- **POLS 316 International Relations (3)** Decision-making behavior of international actors; strategies of peacemaking. Pre: sophomore standing or higher, or consent. **DS**
- **POLS 324 Global Environmental Politics (3)** Evolution of international politics, law and decision-making on a variety of environmental concerns; from endangered species to pollution to climate change. Interaction of population, development, and environment in global governance. (Cross-listed as SUST 324) **DS** **Sustainability Science Track (option, see Notes)*
- **POLS 380 Environmental Law and Politics (3)** Focuses on theories, laws, policies, ethics, and sustainable futures of Hawai'i and the U.S. Sophomore standing or higher. Pre: any 100 or 200 level POLS course, or consent. **(Alt. years)** (Cross-listed as SUST 380) **DS** **Sustainability Science Track (option, see Notes)*
- **POLS 387 Politics of the Ocean (3)** Study of the ocean as a political place. Engagement with theories, policies, and lived-experiences of the ocean through a political lens, including literature and experiential learning. Sophomore standing or higher. A-F only. Pre: any 100 or 200-level POLS course, or consent. (Cross-listed as SUST 387) **DS** **Sustainability Science Track (option, see Notes)*
- **SOC 412 Analysis in Population and Society (3)** Global and U.S. patterns of population growth; composition and distribution, elementary demographic techniques; development issues and population policy. Pre: 300 or consent. (Cross-listed as GHPS 412) **DS**

- **SUST 304 Global and Local Perspectives on Severe Weather (3)** Dynamics and structure of the main types of severe weather (tropical cyclones, supercell storms, tornadoes, flash floods, hailstorms, fog, etc.); future changes due to climate change; risk assessment; severe weather in Hawai'i. ATMO, GES, GG, GEO, GES, NREM, or OCN students only. A-F only. (Alt years: Spring) (Cross-listed as ATMO 304 and GES 304) **DP** *Sustainability Science Track (option, see Notes)
- **SUST 311 Natural Resources Management (3)** Biological and physical science aspects of natural resource management at local, national, and global scales. Topics covered include resource management of soil, water, forests, wetlands, coasts and wildlife. A-F only. Pre: NREM/TPSS 251 or 210; CHEM 151 or higher; and BIOL 172; or consent. (Spring only) (Cross-listed as NREM 301) **DB** *Sustainability Science Track (option, see Notes)
- **SUST 312 Natural Resource and Environmental Policy (3)** Introduction to American government policy in natural resources and environmental protection at federal, Hawai'i state and county levels. Policy principles, legal structure, governmental agencies, major statutes and programs, analytical techniques, program assessments. A-F only. Pre: NREM/PEPS/SUT 210 or (BIOL 101 or higher) or GEOG 101 or (ERTH 101 or higher); and 220/SUST 220 or one ECON course or two DS courses. (Cross-listed as NREM 302) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 314 Global Environmental Issues (3)** Use and abuse of natural resources and humanity's progress toward developing a sustainable relationship with its supporting environment. A-F only. (Once a year) (Cross-listed as GEOG 302) *Sustainability Science Track (option, see Notes)
- **SUST 318 Race, Indigeneity, and Environmental Justice (3)** Introduction to environmental justice, explores the premise that all people have a right to a life-affirming environment. Will examine environmental racism, and the geographical dimensions of race and indigeneity. Pre: one DS or DH course, or consent. (Cross-listed as ES 308) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 320 Environment and Agriculture (3)** Overview of environmental issues and impacts associated with agriculture, specifically pest management issues, and options for environmentally responsible management and amelioration of these impacts. (Cross-listed as PEPS 310) *Sustainability Science Track (option, see Notes)
- **SUST 323 Applied Principles of Environmental & Energy Policy (3)** Introduction to the methods and techniques of environmental and energy policy in relation to energy systems. Analysis of enacted policies from case studies to understanding the effectiveness, challenges, contradictions, and limitations of each. A-F only. Pre: any 100 or 200 level OCN course, or consent. Junior standing or higher. (Cross-listed as OCN 321 and PPC 340) *Sustainability Science Track (option, see Notes)
- **SUST 324 Global Environmental Politics (3)** Evolution of international politics, law and decision-making on a variety of environmental concerns; from endangered species to pollution to climate change. Interaction of population, development, and environment in global governance. (Cross-listed as POLS 324) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 332 Economics of Global Climate Change (3)** Nature and causes of global climate change and economic solutions. Topics include valuing climate change impacts, energy solutions, environmental implications, societal adaptation, and international cooperation. A-F only. Pre: 120 or 130 or 131, or consent. (Once a year) (Cross-listed as ECON 332) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 333 Climate Change and Cultural Response: Past, Present, and Future (3)** Climate change is a reality, yet there is much uncertainty about how it will affect our lives. Investigates cultural response to climate change, using studies of the past to plan for the future. (Alt. years: spring) (Cross-listed as ANTH 333) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 380 Environmental Law and Politics (3)** Focuses on theories, laws, policies, ethics, and sustainable futures of Hawai'i and the U.S. Sophomore standing or higher. Pre: any 100 or 200 level POLS course, or consent. (Alt. years) (Cross-listed as POLS 380) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 387 Politics of the Ocean (3)** Study of the ocean as a political place. Engagement with theories, policies, and lived-experiences of the ocean through a political lens, including literature and experiential learning. Sophomore standing or higher. A-F only. Pre: any 100 or 200-level POLS course, or consent. (Cross-listed as POLS 387) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 411 The Ethics of Climate Change and Geoengineering (3)** Provide a scientific basis to examine the consequences of climate change and the proposed geoengineering solutions, and examine the fundamental ethical basis that underlies environmental policy. A-F only. Pre: 310, or consent. (Spring only. Alternate years.) (Cross-listed as OCN 411) *Sustainability Science Track (option, see Notes)
- **SUST 415 Nature-Based Tourism Management (3)** Principles of nature-based tourism, including a survey of impacts, objectives, planning, and management systems. Junior standing or higher. Pre: 324/TIM 324 or TIM 101. (Cross-listed as GEO 415 and TIM 415) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 421 Sustainable Tourism Policies and Practices (3)** Seminar examining the social, environmental, economic factors of sustainable tourism development. Emphasis on methods and processes and the role of stakeholders (government, industry, host community, tourists). Group projects. A-F only. Pre: 101 and departmental approval. (Cross-listed as TIM 420) *Sustainability Science Track (option, see Notes)
- **SUST 425 Environmental Geochemistry (3)** Theory and applications of contaminant/pollutant distribution in the hydrosphere-geosphere-biosphere-atmosphere system, remediation methods, prevention, industrial/agricultural best practices. Topics include

aqueous geochemistry, organic, inorganic, gas phase, and ecosystem impacts of environmental contaminants. Pre: CHEM 161 and CHEM 162, or consent. (Spring only) (Cross-listed as EARTH 425) **DP** *Sustainability Science Track (option, see Notes)

- **SUST 427 Beaches, Reefs, and Climate Change (3)** Global and local aspects of climate change and paleoclimate; beach and reef processes and response to climate change; management of coastal environments; field study local sites. Repeatable one time. Junior standing or higher, or consent. (Cross-listed as EARTH 420) **DP** *Sustainability Science Track (option, see Notes)
- **SUST 441 Principles of Sustainability Analysis (3)** Introduction to the principles of sustainability analysis through execution of Life Cycle Analysis applied to products, processes, or systems. LCA and the evaluation of environmental impact will be presented. Personal computer or laptop (Word 97 or higher) OS, and minimum of 4GB RAM. Repeatable one time. Junior standing or higher. A-F only. Pre: (CHEM 161 and PHYS 170) with a minimum grade of C-; or consent. (Fall only) (Cross-listed as CEE 441 and OCN 441) *Sustainability Science Track (option, see Notes)
- **SUST 442 Principles of Environmental Management Systems (3)** Introduction to the process of developing Environmental Management Systems that address the principles outlined in ISO14001:2015. Repeatable one time. Junior standing or higher. A-F only. (Spring only) (Cross-listed as OCN 442 and TIM 462) *Sustainability Science Track (option, see Notes)
- **SUST 449 Climate Modeling, Data Analysis and Applications (3)** Introduction to regional and global climate modeling for environmental scientists and engineers. Learn principles of climate modeling, how to access and use climate data for sustainable engineering and environmental management solutions, and effectively communicate results. Repeatable one time. ATMO, CEE, EARTH, GES, OCN, NREM majors only. Senior standing or higher, or consent. (Cross-listed as ATMO 449 and CEE 449) *Sustainability Science Track (option, see Notes)
- **SUST 451 Wildlife Ecology and Management (3)** Lecture-based overview of the history, ecology, and management of wildlife species from around the world and Hawai'i. Pre: BIOL 172 or consent. (Fall only) (Cross-listed as NREM 450) *Sustainability Science Track (option, see Notes)
- **SUST 457 'Āina Mauliola: Hawaiian Ecosystems (3)** Comprehensive analysis of traditional Hawaiian and modern resource management practices. Rigorous overview of the dominant physical and biological processes from the uplands to the oceans in Hawai'i. Pre: 105 or 107, HWST 107, and junior standing; or consent. (Cross-listed as BOT 457 and HWST 457) *Sustainability Science Track (option, see Notes)
- **SUST 458 Project Evaluation and Resource Management (3)** Principles of project evaluation and policy analysis. Shadow pricing, economic cost of taxes and tariffs; public policy for exhaustible, renewable, and environmental resources. Pre: 301. (Cross-listed as ECON 458) **DS** *Sustainability Science Track (option, see Notes)
- **SUST 460 Hui Konohiki Internship: Applied Resource Management (3)** A "hands-on" internship in an environmental or resource-management organization in Hawai'i. The experience will be broadened and supplemented by classroom lectures, discussion and analysis from traditional Hawaiian, scientific and economic perspectives. A-F only. Pre: BOT/HWST/SUST 457, BOT/HWST 458 (or co-requisite), BOT/HWST 459; or consent. (Spring only) (Cross-listed as BOT 460 and HWST 460) *Sustainability Science Track (option, see Notes)
- **ZOOL 466 Fisheries Science (3)** General characteristics of fisheries; harvesting methods; principles and techniques to derive data and analyze fished populations. Field trips. Pre: one of the following: 410, 465, 470, 608, or 620; or consent. **DB**

KEY:

- †BAM – Bachelor's-and-Master's accelerated pathway
- MSF – Master of Science in Finance
- MPH – Master of Public Health, Epidemiology Emphasis
- MURP – Master of Urban and Regional Planning

NOTES:

1. Course descriptions and offering schedules are correct at the time these courses were added to this list but they may have since been updated by the respective departments without our knowledge. Students should confirm their eligibility (i.e. check prerequisites or major restriction or class standing restriction, etc.) before registering in any of these courses.

2. Sustainability Science Track:

Requires four courses (three credits each):

- SUST 441 Principles of Sustainability Analysis (3) (cross-listed CEE 441, OCN 441) **[REQUIRED]**
- SUST 442 Environmental Management Systems (3) (cross-listed OCN 442, TIM 462) **[REQUIRED]**
- Any two upper division (300-level or greater) SUST course on this list marked with *Sustainability Science Track (option, see Notes)
 - e.g. SUST 323 Applied Principles of Environmental & Energy Policy (3) (cross-listed OCN 321, PPC 340)
 - All other SUST courses must be approved by the GES Program prior to registration