

Course Listings for the Minor in Spatial Studies

Core courses are highlighted as **Spatial Thinking**, **Space and Place**, and **Spatial Science**

Updated December 2016

Course Number and Title	Units	Description
ANTH 130A , Coupled Human and Natural Systems and Risks, Vulnerability, Resilience and Disasters	4	Stonich <i>Prerequisite: Anthropology 2 or Environmental Studies 1 or 3.</i> <i>Quarters usually offered: Fall. Same course as Anthropology 130A.</i> Examines human dimensions of global environmental change in developing countries from an interdisciplinary social science perspective. Compares and contrasts alternative conceptual and analytical models of dynamic, interrelated human-environmental systems and presents recent approaches to understanding risk, vulnerability, resilience, and disasters.
ANTH 130C , Global Food Systems and Human Food Security	4	Stonich <i>Prerequisite: Anthropology 2 or Environmental Studies 1 or 3.</i> <i>Quarters usually offered: Spring. Same course as Environmental Studies 130C.</i> Recommended preparation: <i>Environmental Studies 130A or 130B or Anthropology 130A or 130B.</i> Examines history of global food system and its impacts on ecosystems, ecologies, and human nutrition and food security. How agricultural, capture fisheries, and aquacultural industries were integrated into the global food system. Provides information to make more informed decisions about consuming these products.
ANTH 145 , Anthropological Demography and Life History	4	Gurven Introduces students to anthropologic applications of demography and life history theory. Focuses on ecological approaches to population dynamics, birth and death processes, and policy implications in light of population “problems” among traditional and modern societies.
ANTH 148 , Ecological Anthropology	4	Aswani <i>Prerequisites: Anthropology 2; upper-division standing.</i> Focuses on the complex and dynamic interactions between human beings and their physical environment. Examines ecological thinking in anthropology and the various theoretical approaches within the discipline that have developed from the coalescence of natural and social sciences.
ANTH 149 . World Agriculture, Food, and Population	4	CLEVELAND <i>Prerequisite: Upper-division standing.</i> Enrollment Comments: <i>Same course as Environmental Studies 149 and Geography 161.</i> Evolution, current status, and alternative futures of agriculture, food, and population worldwide. Achieving environmentally, socially, and economically sustainable food systems; soil, water, crops, energy, and labor; diversity, stability, and ecosystems management; farmer and scientist knowledge and collaboration; common property management.
ANTH 160 , Cultural Ecology	4	Jochim <i>Prerequisite: Anthropology 2.</i> Ranging from moose hunters to rice farmers, cultures seem tremendously diverse, yet cultural forms do show clear patterns. The relationship of these patterns to the natural and social environment will be examined.
ANTH 164 . The Origins of Complex Societies	4	VANDERWARKER <i>Prerequisite: Anthropology 3 or 3SS.</i> Why and how complex societies developed from simple, egalitarian societies in some areas of the world. Course surveys major theories and evidence surrounding the origins of states and urban societies in New and Old World.
ANTH 182 . Quantitative Data Analysis in Archaeology	4	VANDERWARKER <i>Prerequisite: Anthropology 3 or 3SS or 100.</i> This course is an introduction to the practical analysis of commonly encountered archaeological data using simple quantitative and statistical procedures such as exploratory data analysis, sampling, regression, and spatial analysis. The course is taught in a computer-assisted (multimedia) format.
ANTH 184 , Settlement Pattern Analysis in Archaeology	4	Schreiber <i>Prerequisites: Anthropology 3; not open to freshmen.</i> <i>Recommended preparation: upper-division courses in archaeology.</i> How the arrangement of archaeological sites across the landscape indicates aspects of human culture, including subsistence strategies and socio-political complexity. Methods of obtaining and interpreting settlement data.
ARTHI 103A , Roman Architecture	4	Yegul <i>Prerequisite: Not open to freshman.</i>

		Recommended Preparation: <i>Art History 6A.</i> The architecture and urban image of Rome and the Empire from the Republic through the Constantinian era.
ARTHI 103C, Greek Architecture	4	Yegul Prerequisite: <i>Not open to freshman.</i> The architecture of the Greek world from the archaic period through the Hellenistic age.
ARTHI 109G, Leonardo da Vinci: Art, Science, and Technology in Early Modern Italy	4	Williams Prerequisite: <i>not open to freshmen.</i> The life and work of Leonardo da Vinci and a consideration of their place in the history of art as well as in the development of early modern science and technology.
ARTHI 113F, Bernini and the Age of the Baroque	4	Paul Prerequisite: <i>Not open to freshmen.</i> Examines the life and work of Gianlorenzo Bernini, best known as a brilliant and innovative sculptor, in their historical context. Also considered is the international influence that Bernini exerted on seventeenth- and eighteenth-century art.
ARTHI 115E, The Grand Tour: Experiencing Italy in the Eighteenth Century	4	Paul Prerequisite: <i>Not open to Freshmen.</i> In the eighteenth century Italy was a mecca for European travelers who sought to enjoy its culture, diversions, landscape, and society. This course will examine the multifaceted experiences of these travelers and the ways in which they constitute the beginnings of the phenomenon of modern tourism.
ARTHI 119D, Art in the Post-Modern World	4	Monahan Prerequisite: <i>Upper-division standing.</i> An examination of the concepts of “Post-Modernism” in Euro-American visual arts, including painting, sculpture, architecture, graphic arts, and new experimental genres from the 1970s to the present.
ARTHI 119G. Critical Approaches to Visual Culture	4	Monahan Prerequisite: <i>A prior course in art history; not open to freshmen.</i> Recommended Preparation: <i>Art History 6C or any upper division modern course.</i> Critical ways of approaching and understanding a wide range of visual materials and images (paintings, ads, videos, etc.). Analytic approaches to culture and representation are used as a means of developing descriptive and interpretive skills.
ARTHI 132A, Mediterranean Cities	4	Khoury Prerequisite: <i>Not open to freshmen.</i> An exploration of the most important Medieval cities of the Mediterranean world, their urban forms, layout, architecture, and physical patterns. Venice, Cairo, and Baghdad will be among the cities discussed.
ARTHI 132C, Architecture and Ideology from Constantine to Suleyman the Magnificent	4	Khoury Prerequisite: <i>Not open to freshmen.</i> Byzantine and Islamic architecture
ARTHI 132D, Islamic Architecture 650–1400	4	Khoury Prerequisite: <i>Not open to freshmen.</i> Islamic architecture between 650 and 1400 in its historical content.
ARTHI 132E, Islamic Architecture 1400–Modern	4	Khoury Prerequisite: <i>Not open to freshmen.</i> <i>Not open for credit to students who have completed Art History 176B.</i> Islamic architecture, 1400–modern, in its historical context.
ARTHI 132G, Monuments of Power	4	Khoury Prerequisite: <i>Not open to freshmen.</i> Historical documents and contemporary interpretations are used to explore the ways in which messages of dominance and power were embedded into Islamic monuments from the seventh century to modern times. A comparative, crosscultural approach focusing on the power of architectural monuments in relation to the power to create architectural monuments.
ARTHI 136A, Nineteenth-Century Architecture	4	Chattopadhyay Prerequisite: <i>not open to freshmen.</i> The history of architecture and planning beginning with eighteenth-century architectural trends in Europe and concluding with late-nineteenth century efforts to reform the city. Exploration of the culture of nineteenth-century modernity through architecture and urban design, centered on the themes of industrialization, colonialism, and the idea of landscape. The scope is global.
ARTHI 136B, Twentieth-Century	4	Chattopadhyay Prerequisite: <i>not open to freshmen.</i>

Architecture		The history of architecture from 1900 to the present. Examination of modern and post-modern architecture and city planning in its social, political, and artistic context. The scope is global.
ARTHI 136C, Architecture of the United States	4	White <i>Prerequisite: Not open to freshmen. Quarters usually offered: Summer.</i> History of architecture and urban planning: buildings and builders, patrons and occupants, but especially the historical forces and events that transformed the landscape. Course subjects include art, design, technology, economics, politics, and social forces
ARTHI 136D, Design & the American Architect	4	White <i>Prerequisite: Not open to freshmen. Quarters usually offered: Fall.</i> Course examines problems faced by the architectural profession today, as well as the role played by architects in the design process and in society at large. It also reviews how the architectural profession has developed in the past two centuries.
ARTHI 136H, Housing American Cultures	4	Chattopadhyay, White <i>Prerequisite: Not open to freshmen.</i> The history of American domestic architecture from the colonial period to the present within a framework of cultural plurality. Examination of the relation between ideas of domesticity, residential design, individual, regional, and ethnic choices.
ARTHI 136I, The City in History	4	Chattopadhyay <i>Prerequisite: not open to freshmen.</i> An historical introduction to the ideas and forms of cities with emphasis on modern urbanism. Examination of social theory to understand the role of industrial capitalism and colonialism in shaping the culture of modern cities, the relationship between the city and the country, the phenomena of class, race, and ethnic separation.
ARTHI 136J, Landscape of Colonialism	4	Chattopadhyay <i>Prerequisite: not open to freshmen.</i> Examination of architecture, urbanism, and the landscape of British and French colonialism between 1600 and 1950. Introduction to the different forms of colonialism, colonial ideology and the architecture of colonial encounter in North America, Asia, Africa, and Australia.
ARTHI 136K, Modern Architecture in Early Twentieth- Century Europe	4	Welter <i>Prerequisite: Not open to Freshmen</i> Recommended Preparation: ARTHI 5A and/or ARTHI 6F. <i>Please restrict to ARTHI Majors on first pass only.</i> History of modern architecture in Europe in the early twentieth century. Focuses on movements (for example, Art Nouveau, Futurism, Expressionism, Bauhaus, De Stijl, and Constructivism) and on individual architects (for example, Le Corbusier, Gropius, Mies van der Rohe.)
ARTHI 136L, From Modernism to Post- Modernism in European Architecture	4	Welter <i>Prerequisite: Not open to Freshmen.</i> Recommended Preparation: ARTHI 5A and/or ARTHI 6F. <i>Restricted to ARTHI majors only on first pass.</i> History of European architecture from the mid-twentieth century onwards with emphasis on alternatives to Modernism like, for example, Post-Modernism, Deconstructivism, Critical Regionalism, Neo-Traditionalism, and Neo-Classicism.
ARTHI 136M, Revival Styles in Southern California Architecture	4	Welter <i>Prerequisite: not open to freshmen.</i> Examines the history of revival styles in Californian architecture from the eighteenth century to the present. While the focus is on Southern California, such comparative phenomena as National Romanticism in Western Architecture and Critical Regionalism are incorporated.
ARTHI 136O, Sustainable Architecture: History and Aesthetics	4	Welter <i>Prerequisite: not open to freshmen. Art History 5A or 6F.</i> Examines history and theory of sustainable and “green” architecture since the early twentieth century. Emphasis is placed on the critical analysis of a distinct “green” architectural aesthetic; the scope is global.
ARTHI 136P, Frank Lloyd Wright	4	Welter Recommended Preparation: Art History 5A or 6F <i>Quarters usually offered: Winter, Spring.</i> The career and work of Wright with emphasis on his ideas about architecture in relation to both nature and free, democratic society, his contemporaries, and his importance in the history of modern architecture in the US and beyond.
ARTHI 136R, Architecture of the Americas	4	White From antiquity to the present North and South America have been home to a dizzying variety of architectural and urban traditions. Emphasis on the movement of ideas and people, as well as economic,

		social, technological and political influences.
ARTHI 136S. Contemporary Architecture	4	White, Chattopadhyay <i>Prerequisite:</i> Not open to freshmen. Presents a critical overview of global architecture since 1990 and focuses on three conditions that have changed architectural practice: the impact of digital media and computer-aided design and construction, globalization and geo- political shifts, and the environmental crisis.
ARTHI 136W, Introduction to 2D/3D Visualizations in Architecture	4	White <i>Prerequisite:</i> upper-division standing; open to majors only. Same course as Art 106W. Develops skills in reading, interpreting, and visualizing in 3D objects and spaces by offering exercises in sketching, perspective, orthographic projections, isometric drawings, and manual rendering practices. Relevant for those interested in history of architecture, architecture, sculpture, and such spatial practices as installations and public art. <i>Note: Students in Spatial Studies Minor require consent of instructor</i>
ARTHI 136X, Culture of Architecture: Perception and Analysis of the Built Environment	4	Yegul <i>Prerequisite:</i> not open to freshmen. Introduces the student to a first-hand experience of the built environment through perception and analysis of design; understanding historical, theoretical, technical and artistic structures that shape and sustain the culture of architecture
ARTHI 136Y, Modern Architecture in Southern California, C. 1890s to the Present	4	Welter <i>Prerequisite:</i> not open to freshmen. <i>Recommended preparation:</i> Art History 5A and/or 6F. Critically analyzes the changing definitions of modern architecture in Southern California from the 1890s to the present, focusing on the work of architects like Green and Greene, R.M. Schindler, and R. Neutra, as well as the Case Study Houses.
ARTHI 140E, Landscape Design History	4	Staff <i>Prerequisite:</i> not open to freshmen. Explore the significance of landscape design through social, political, and artistic influences and interpret “humanity’s control over Nature” and how this affects our view of nature. Discover how and why landscape design canons were formed.
ARTHI 142A, Architecture and Planning in Seventeenth-Century Europe	4	Wittman <i>Prerequisite:</i> not open to freshmen. How did major changes in politics, science, and religion (absolutism, Scientific Revolution, Counter Reformation) manifest themselves in contemporary architecture and town planning? Architects include Bernini, Borromini, Wren, Mansart. Focus on Rome, Turin, Paris, and London
ARTHI 142B, Architecture and Planning in Rome: Napoleon to Mussolini	4	Wittman <i>Prerequisite:</i> Not open to freshmen. <i>Substantial overlap between ARTHI 142B and ARTHI 142C.</i> Transformation of Rome from a pre-modern to a modern city. Napoleonic occupations of 1798–1814; papal initiatives from 1815–70; Rome transformed into the new national capital 1870–1922; Mussolini's massive public works in the 1920s and 1930s
ARTHI 142C, Paris and Rome in the Nineteenth Century	4	Wittman <i>Prerequisite:</i> Not open to freshmen. <i>Substantial overlap between ARTHI 142B and ARTHI 142C</i> Comparative history of how two great cities were transformed from pre-modern to modern; focus on architecture and design as well as politics, economics, and culture; emergence of new ideas about the very concept of “the city.”
ARTHI 142D, Gardens, Land, and Landscape in the West: Renaissance to 1900	4	Wittman <i>Prerequisite:</i> not open to freshmen Changing nature of garden and landscape design from the Renaissance to NYC’s Central Park, studied as a function of the changing functions and status of land during the long passage from feudalism to industrial capitalism.
ARTHI 142E, Architecture, Planning, and Culture in Eighteenth-Century Paris	4	Wittman <i>Prerequisite:</i> Not open to freshmen. Paris (and Versailles) from the Sun King to the Revolution, rococo, neoclassicism, origins of urbanism; extensive use of primary texts in translation to study architectural debates in the press and their connection to contemporary political battles.
ARTST 102, Digital Media Tool Box: Concepts and Skills	4	Staff <i>Prerequisite:</i> Art Studio 1A, and 22. <i>Recommended Preparation:</i> Art Studio 7D. May be repeated for credit to a maximum of 16 units. A project based course with an emphasis on technical skills within the digital media arts context. Topics

		may include telecommunications, wireless, database aesthetics, networks, interactivity, digital 3D, virtual reality, immersive environments, algorithmic aesthetics, visualization, media theory, and others. Topic to be determined by instructor.
ARTST 105, Intermediate Spatial Practices	4	Staff Prerequisites: Art Studio 1A-B, 7A-B-C, and 12; consent of instructor. <i>May be repeated for credit to a maximum of 16 units. Letter-grade required for majors.</i> Develops student knowledge and proficiency of material and method, cultivating both manual and conceptual skill-levels in three-dimensional practices. Course focus varies by quarter, but may include mold-making, casting, metal fabrication, foundry, and related kiln practices. <i>Note: Students in Spatial Studies Minor require consent of instructor.</i>
ARTST 106, Advanced Spatial Practices	4	Staff Prerequisite: Art Studio 105. <i>May be repeated for credit to a maximum of 16 units. Letter grade required for majors.</i> Advanced study of new forms and spatial practices. Individual projects may encompass formal sculptural practices as well as investigations that engage new and alternative technologies such as data-driven forms, alternative architectures, interactive media, cyber/nano/nuero/bio forms, and virtual environments. Course content detailed in syllabus each quarter.
ARTST 106W, Introduction to 2D/3D Visualizations in Architecture	4	Staff Prerequisite: upper-division standing; open to majors only. Same course as History of Art and Architecture 136W. Develops skills in reading, interpreting, and visualizing in 3D objects and spaces by offering exercises in sketching, perspective, orthographic projections, isometric drawings, and manual rendering practices. Relevant for those interested in history of architecture, architecture, sculpture, and such spatial practices as installations and public art. <i>Note: Students in Spatial Studies Minor require consent of instructor.</i>
ARTST 111, Digital Intermedia I	4	Staff The investigation of imagination and visual communication. Students create image and/or text-based projects using digital and hybrid tools, including digital drawing, photography, vector imaging. Project themes and methodologies include site-responsive public space art and distributed multiples.
ARTST 122, Advanced Topics in Digital Media	4	Staff Prerequisite: Art Studio 1A, 22, and 102. Recommended Preparation: Art Studio 7D. <i>May be repeated for credit to a maximum of 16 units.</i> An advanced project based course in digital media arts. Students are expected to have relevant conceptual, aesthetic, and technological grounding in digital media. Topic to be determined by instructor.
ARTST 130, Visual Arts as Culture	4	Staff Prerequisite: upper-division standing. <i>May be repeated for credit to a maximum of 16 units, but only 8 units can be applied to the major.</i> Evolution of visual arts and culture, including the evolving social and practical parameters of technologically produced images and the shifting arenas of ideology, analysis, and criticism. <i>Note: The theme for this course changes regularly, but the content will frequently be of direct relevance to the Minor in Spatial Studies. Consult with instructor.</i>
ARTST 177, Art and Science of Aerospace Culture	4	Staff Prerequisites: upper-division standing; co Prerequisites: upper-division standing; consent of instructor. Same course as Engineering 177. Interdisciplinary course/seminar/practice for artists, academics, engineers, and designers interested in exploring the technological, aesthetic, cultural, and political aspects of the space side of the aerospace complex. Design history, space complex aesthetics, cinema intersections, imaging/telecommunications, human spaceflight history, reduced/alternating gravity experimentation, space systems design/utilization.
CLASS 160, Greek Cities and Sanctuaries	4	Erickson Recommended preparation: Classics 50. Surveys the evidence for the primary archaeological sites of the Archaic, Classical, and Hellenistic Greek world, with special emphasis on town planning and architectural responses to important Greek institutions such as colonization and democracy.
CLASS 170		
C LIT 107, Voyages to the Unknown	4	Skenazi Prerequisites: Writing 2 and 50. <i>Same course as French 154A.</i> The impact of the voyages of discovery on late fifteenth- and sixteenth-century Europe. Readings on real and imaginary voyages: Columbus, Cartier, Lery, More, Rabelais, Montaigne.
C LIT 133, Transpacific Literature	4	Huang Prerequisite: Writing 2 or upper-division standing. Looks at the Pacific as the primary location for literary and historical imagination since the Age of

		Exploration. Studies the crisscross, transpacific field of inscriptions ranging from Captain Cook to Herman Melville, Mark Twain, Jack London and Maxine Hong Kingston.
C LIT 153 , Border Narratives	4	Gutierrez-Jones <i>Prerequisite:</i> Upper-division standing. Examination of novels, short stories, and films that engage U.S./Mexico border dynamics. Considering the ways diverse, interactive processes are affecting border culture, and inquiring into the ways cultural products critically respond to these processes.
C LIT 191 , Fantasy and the Fantastic	4	Levy / Jullien <i>Prerequisite:</i> <i>Same course as French 153D.</i> Course explores the creation of a space where a fantastic perception of reality developed and thrived, hesitating between the real and the supernatural in the intermediate space of the unexplained and unexplainable. Works by Balzac, Poe, Merimée, Stevenson, James, and Borges.
CMPS 180 , Computer Graphics	4	Wang <i>Prerequisites:</i> Computer Science 130B or consent of instructor. Overview of OpenGL graphics standard, OpenGL state machine, other 3D graphics libraries, 3D graphics pipeline, 3D transformations and clipping, color model, shading model, shadow algorithms, texturing, curves and curved surfaces, graphics hardware, interaction devices and techniques
CMPS 181B , Introduction to Computer Vision	4	Wang/Turk <i>Prerequisite:</i> Upper-division standing. <i>Same course as ECE 181B.</i> Overview of computer vision problems and techniques for analyzing the content images and video. Topics include image formation, edge detection, image segmentation, pattern recognition, texture analysis, optical flow, stereo vision, shape representation and recovery techniques, issues in object recognition, and case studies of practical vision systems.
EACS 171 , Buddhism and Local Cults in Asia	4	Rambelli <i>Prerequisite:</i> One lower division or upper division course on Buddhism, or prior approval of the instructor. <i>Same course as Religious Studies 171.</i> This course examines the multiple ways in which various Buddhist traditions have interacted with “local” cults in various parts of Asia (including China, Tibet, Japan, Burma, and Thailand). We will discuss issues of localization and translocalization as important religious phenomena.
EARTH 104A , Field Studies in Geological Methods	4	Staff <i>Prerequisites:</i> Geology 2 and 3 and consent of instructor. Introduction to the methods of geological observations and interpretations, with an emphasis on understanding earth processes in the field and reconstructing the physical history of the earth; the stratigraphic, petrologic, and structural relations of rocks; geologic report writing.
EARTH 104B , Field Methods	4	STAFF <i>Prerequisite:</i> Earth 114 and 103. All with a C- or better. <i>Enrollment Comments:</i> Course materials fee required. Geologic mapping on topographic maps and aerial photographs; use of geologic field instruments; field techniques; preparation of geologic maps and reports. Field work is completed during the break and between winter and spring quarters.
EARTH 137 , Quantitative Geomorphology	5	Bookhagen <i>Prerequisite:</i> Geography 3B; or Earth Science 2 <i>Recommended Preparation:</i> Basic knowledge of MATLAB <i>Concurrently offered with EARTH 237.</i> Basic quantitative understanding of processes shaping Earth's surface. In-depth evaluation of hill slope diffusion, mass wasting, and fluvial processes. Applications of quantitative methods are emphasized throughout class. Laboratory provides understanding of isotopic, physical, and remote sensing data.
EARTH 176 , Geological Application of GIS	4	Staff <i>Prerequisites:</i> Upper division standing. Instructor approval required prior to enroll. An intensive introduction to Geographic Information Systems (GIS) with an emphasis on geological applications, including geologic mapping, topographic analysis, modeling surface processes and river networks, importation and interpolation of field data, and spatial analysis and correlation of multiple geologic datasets.
EARTH 183 , Advanced Field Mapping and Geologic Investigations	4	GANS <i>Prerequisite:</i> Earth 118 or equivalent. <i>Enrollment Comments:</i> Concurrently offered with Earth 283. Course materials fee charged. Research oriented mapping projects to solve outstanding problem(s) in a geologically significant area. Two weeks in the field, followed by compilation and complimentary laboratory studies. Weekly meetings

		to discuss results.
ECE 181B , Introduction to Computer Vision	4	Manjunath <i>Prerequisites: Upper-division standing. Same course as Computer Science 181B.</i> Overview of computer vision problems and techniques for analyzing the content of images and video. Topics include image formation, edge detection, image segmentation, pattern recognition, texture analysis, optical flow, stereo vision, shape representation and recovery techniques, issues in object recognition, and case studies of practical vision systems.
ECON 120 , Urban and Regional Economics	4	Sonstelie <i>Prerequisite: Economics 100B or 104B.</i> Economic analysis applied to current urban and regional problems.
ECON 122 , Natural Resource Economics	4	DEACON <i>Prerequisite: Economics 10A or 100A or 104A.</i> <i>Enrollment Comments: Same course as Environmental Studies 179.</i> Microeconomic theory and capital theory applied to problems of conservation and management of natural resources. Analysis of public policy with special emphasis on nonrenewable energy resources, management of forests, deforestation and species extinction, and use of fish and game resources.
EEMB 128 , Foundations of Ecosystem Restoration	4	D'Antonio <i>Prerequisites: Environmental Studies 100 or EEMB 120.</i> <i>Same course as Environmental Studies 128. Lecture, 3 hours; laboratory, 2 hours.</i> Integrates ecological principles with practical issues involved in ecosystem restoration. Beginning with the challenge of selecting goals and establishing a target trajectory, students evaluate how ecological knowledge can guide restoration and whether sustainable states or trajectories can be achieved.
EEMB 142A , Aquatic Communities	4	Cooper/Schmitt/Even <i>Prerequisites: MCDB 1A, EEMB 2 and MCDB 1B, and EEMB 3.</i> <i>Not open for credit to students who have completed EEMB 145C.</i> <i>Recommended preparation: EEMB 120. Lecture, 3 hours; discussion, 1 hour.</i> A survey of the patterns of distribution, diversity, and abundance of species in marine and freshwater communities, with an emphasis on the dynamic interactions which shape these patterns. Applied aspects: fisheries, mariculture.
EEMB142AL , Methods of Aquatic Community Ecology	3	Cooper/Schmitt/Even <i>Prerequisite: concurrent enrollment in EEMB 142A.</i> <i>Not open for credit to students who have completed EEMB 145CL. Laboratory, 6 hours; discussion, 1 hour.</i> Experience in the field techniques of aquatic community ecology.
EEMB 142B , Environmental Processes in Oceans and Lakes	4	Prezelin/MacIntyre/Carlson <i>Prerequisites: MCDB 1A; and, MCDB 1B and EEMB 2; and EEMB 3.</i> <i>Not open for credit to students who have completed EEMB 145A. Lecture, 3 hours; discussion, 1 hour.</i> A discussion of biological, chemical, physical, and optical processes in marine and freshwater environments and the linkage between these processes. Emphasis on primary production, global biogeochemical cycles, nutrient dynamics, and synoptic mapping of biological and physical patterns.
EEMB 142C , Environmental Processes in Oceans and Lakes	4	Cooper <i>Prerequisite: EEMB 142B.</i> <i>Not open for credit to students who have completed EEMB 145B. Lecture, 3 hours; discussion, 1 hour.</i> A continuation of EEMB 142B with emphasis on secondary productivity, ecology of higher trophic levels including zooplankton and fish, food web dynamics, benthic-pelagic coupling, ocean circulation, and biogeographical aspects of pelagic communities.
EEMB 152 , Applied Marine Ecology	5	Schmitt, Holbrook <i>Prerequisite: Env. Studies 100, or EEMB 2 and MCDB 1B, or EEMB 3; and Mathematics 3A or 34A.</i> <i>Recommended Preparation: EEMB 120.</i> <i>Same course as Environmental Studies 152.</i> Introduction to the application of ecological principles and methods to environmental problems in marine habitats. Focus on problems that are local, regional, and global in scale. Concepts illustrated with case studies.
ENGL 133 , Studies in American Regional Literature	4	Staff Courses on American writing associated with particular regions such as the South, the West, New England.
ENGR 177 , Art and Science of Aerospace Culture	4	Staff <i>Prerequisites: upper-division standing; co Prerequisites: upper-division standing; consent of instructor.</i> <i>Same course as ARTST 177.</i> Interdisciplinary course/seminar/practice for artists, academics, engineers, and designers interested in exploring the technological, aesthetic, cultural, and political aspects of the space side of the aerospace

		complex. Design history, space complex aesthetics, cinema intersections, imaging/telecommunications, human spaceflight history, reduced/alternating gravity experimentation, space systems design/utilization.
ENV S 100. Environmental Ecology	4	SCHIMEL Prerequisite: <i>Environmental Studies 2; and, Environmental Studies 1 or 3; and, MCDB 20 or EEMB 22 or MCDB 1A-AL and EEMB 2.</i> A study of principles of ecology and their implications for analyzing environmental problems. Focus on understanding the processes controlling the dynamics of populations, communities and ecosystems. Specific examples emphasize the application of these concepts to the management of natural resources.
ENV S 107. History of Global Environmental Problems	4	STAFF Enrollment Comments: <i>Same course as History 107G.</i> Survey of global environmental problems from antiquity to the present. Topics include demography, agriculture, climate change, disease, and storage of toxic waste.
ENV S 110, Disease and the Environment	4	Staff Prerequisite: <i>Environmental Studies 1 or 3.</i> The interaction of human and animal disease and the environment through case studies, from the Black Death of 1300s to asthma, AIDS and the Ebola virus. “Environment” is broadly defined to include both natural and built environments.
ENV S 114A, Soil Science	5	Chadwick Prerequisites: <i>Chemistry 1A-B; and, Geography 3B or Geology 2.</i> <i>Same course as Geography 114A.</i> Introduction to the chemical, hydrological, and biological characteristics of soils, their global distribution, and their response to management. Field and laboratory projects are designed to provide an understanding of soil-landscape distribution, soil morphology, and the physical and chemical properties that influence management decisions.
ENV S 128 Foundations of Ecosystem Restoration		TBA Prerequisites: <i>Environmental Studies 100 or EEMB 120.</i> <i>Same course as EEMB 128. Lecture, 3 hours; laboratory, 2 hours.</i> Integrates ecological principles with practical issues involved in ecosystem restoration. Beginning with the challenge of selecting goals and establishing a target trajectory, students evaluate how ecological knowledge can guide restoration and whether sustainable states or trajectories can be achieved.
ENV S 130A, Coupled Human and Natural Systems and Risks, Vulnerability, Resilience and Disasters	4	Stonich Prerequisite: <i>Anthropology 2 or Environmental Studies 1 or 3.</i> <i>Quarters usually offered: Fall. Same course as Anthropology 130A.</i> Examines human dimensions of global environmental change in developing countries from an interdisciplinary social science perspective. Compares and contrasts alternative conceptual and analytical models of dynamic, interrelated human-environmental systems and presents recent approaches to understanding risk, vulnerability, resilience, and disasters.
ENV S 130C, Global Food Systems and Human Food Security	4	Stonich Prerequisite: <i>Anthropology 2 or Environmental Studies 1 or 3.</i> <i>Quarters usually offered: Spring. Same course as Anthropology 130C.</i> Recommended preparation: <i>Environmental Studies 130A or 130B or Anthropology 130A or 130B.</i> Examines history of global food system and its impacts on ecosystems, ecologies, and human nutrition and food security. How agricultural, capture fisheries, and aquacultural industries were integrated into the global food system. Provides information to make more informed decisions about consuming these products.
ENV S 134, Coastal Processes and Management	4	Staff Prerequisites: <i>Environmental Studies 2; Mathematics 3A or 34A or Environmental Studies 25; and, Geology 1 or 2 or 4 or 20 or Geography 3A or 3B.</i> Recommended preparation: <i>Introductory Biology.</i> Using representative coastal regimes, students study the major processes at work in our nation’s coastal zones and examine the nature and efficacy of the planning and management programs that have been put in place in these areas.
ENV S 135A, Principles of Environmental Planning	4	Wack Prerequisite: <i>upper-division standing.</i> Introduction to the history, theory, and trends of urban, regional, and environmental planning in both California and the United States. Field trips to local urban areas.
ENV S 135B, Advanced Environmental Planning	4	Wack Prerequisite: <i>Environmental Studies 135A.</i> Advanced seminar applying principles presented in Environmental Studies 135A to regional and local government planning processes. Field analysis of local planning issues.
ENV S 149, World	4	Cleveland

Agriculture, Food, and Population		Prerequisite: upper-division standing. <i>Same course as Anthropology 149 and Geography 161.</i> Evolution, current status, and alternative futures of agriculture, food, and population worldwide. Achieving environmentally, socially and economically sustainable food systems; soil, water, crops, energy, and labor; diversity, stability and ecosystems management; farmer and scientist knowledge and collaboration; common property management.
ENV S 152, Applied Marine Ecology	5	Schmitt/Staff Prerequisites: <i>Environmental Studies 100; or EEMB 2 and MCDB 1B; or EEMB 3; and, Mathematics 3A or 34A.</i> Recommended preparation: <i>EEMB 120. Same course as EEMB 152.</i> Introduction to the application of ecological principles and methods to environmental problems in marine habitats. Focus on problems that are local, regional, and global in scale. Concepts illustrated with case studies.
ENV S 165A, Environmental Impact Analysis	4	Stone Prerequisites: upper-division standing. Recommended preparation: <i>Environmental Studies 116 or 135A.</i> Analyzes the historical and theoretical approaches to environmental assessment methodology and procedures for preparing and reviewing environmental impact reports. Explores strengths and weaknesses of current approaches in current public policy context.
ENV S 165B, Advanced Environmental Impact Analysis	4	Staff Prerequisites: <i>Environmental Studies 165A; consent of department.</i> <i>Other course work and/or experience may be substituted for Environmental Studies 165A, with the consent of the instructor(s).</i> Advanced seminar during which students prepare their own focused environmental impact report on a specific development project. Includes in-depth discussion of baseline, mitigation, impacts, and public comments. Assignments based on research and fieldwork provide reality professional environmental planning experience.
ENV S 167, Biogeography: The Study of Plant and Animal Distributions	4	Still Prerequisites: <i>Geography 3A or 3B or Environmental Studies 2 or EEMB 2 or Geology 2.</i> <i>Same course as Geography 167.</i> Basic processes governing geographic distribution patterns of biota, including migration, evolution, isolation, and endemism. Biogeographic regions and their histories and an introduction to island biogeography. Emphasis on plants and plant geography. One all-day field trip.
ENV S 179. Natural Resource Economics	4	TBA Enrollment Comments: <i>Same course as Econ 122.</i> Microeconomic theory and capital theory applied to problems of conservation and management of natural resources. Analysis of public policy with special emphasis on nonrenewable energy resources, management of forests, deforestation and species extinction, and use of fish and game resources.
ENV S 183, Films of the Natural and Human Environment	4	Wack Prerequisite: upper-division standing. Recommended preparation: <i>Environmental Studies 1 or 2 or 3; and Film Studies 46.</i> Course presents a series of popular films and professional documentaries representing a range of trends, images, and issues associated with the natural and human environments. Visual images and critical thinking skills are combined to enhance understanding of environmental issues presented by the media.
FLMST 183, Films of the Natural and Human Environment	4	Wack Prerequisite: upper-division standing. Recommended preparation: <i>Environmental Studies 1 or 2 or 3; and Film Studies 46.</i> Course presents a series of popular films and professional documentaries representing a range of trends, images, and issues associated with the natural and human environments. Visual images and critical thinking skills are combined to enhance understanding of environmental issues presented by the media.
GEOG W12, Maps and Spatial Reasoning	4	Clarke, Janowicz Surveys properties of maps, emphasizing map use and interpretation. Lecture topics include map abstraction, generalization, map projections, and symbolization. Special purpose maps, thematic maps, and the display of quantitative and qualitative information is considered. <i>Offered online.</i> Note: Geography 12 is the required common course for the Minor in Spatial Studies.
GEOG 101, Transportation Futures	4	Church Prerequisite: Geography 5. Introduction to transportation related problems, involving energy, the environment, congestion, infrastructure, and future trends. Begin with a historical perspective of transportation innovations and their impacts on urban form, and then review current problems from the movement of freight, to the development of transit-oriented neighborhoods.

GEOG 108 , Urban Geography	4	Couclelis, Sweeney Prerequisite: <i>Geography 5.</i> Introduction to the study of the economic geography of cities and regions and its relation to planning: urbanization, internal structure of cities, settlement systems, regional growth and development, migration, transportation, housing.
GEOG 109 , Economic Geography	4	SWEENEY Prerequisite: <i>upper-division standing only</i> Recommended Preparation: <i>Geography 5.</i> Introduction to the study of spatial economic theories with applications at the urban, regional, and global scales. Topics include settlement system dynamics and regional development, land economics and land use policies, and regional inequality and poverty.
GEOG 111A , Transportation Planning and Modeling	4	Goulias Prerequisites: <i>Geography 5.</i> Recommended Preparation: <i>Geography 117 or equivalent, introductory probability and statistics.</i> Issues, problems, technologies, policies, plans, programs, and the transportation-environment relationship. Transportation systems simulation, trip-based and activity data collection and modeling. Applications in planning, design and operations. Lab: Critically examine transportation plans and programs; explore and analyze travel surveys.
GEOG 111B , Transportation Modeling and Simulation	4	Goulias Prerequisites: <i>Geography 111A.</i> Recommended Preparation: <i>a prior course in probability & statistics and regression methods. Economics 140A-B.</i> Multilevel data in time use, activity, and travel surveys. Revealed and stated choice data collection in laboratory/field studies. Regression models. Systems simulation. Applications in policy analysis and traffic operations. Lab: Data analysis to develop models for typical regional simulations.
GEOG 114A , Soil Science	5	Chadwick Prerequisite: <i>Chemistry 1A-B; and Geography 3B or Geology 2.</i> Enrollment Comments: <i>Same course as Environmental Studies 114A.</i> Introduction to the chemical, hydrological, and biological characteristics of soils, their global distribution, and response to management. Field and laboratory projects provide an understanding of soil-landscape distribution, soil morphology, and the physical and chemical properties that influence management decisions.
GEOG 115A , The Earth from Above	5	Bookhagen, McFadden Prerequisite: <i>Geography 3A-B.</i> Recommended Preparation: <i>Geog 12. Lecture, 3 hours; laboratory, 4 hours.</i> Introduction to physical and cultural geographic phenomena as recorded by airborne and satellite remote sensing systems, with emphasis on photo interpretation skills. Lab involves analysis of current and historical aerial photographs and satellite images in hard copy and digital formats.
GEOG 115B , Introduction to Remote Sensing	5	Bookhagen, Clarke, McFadden Prerequisites: <i>Geography 115A with a minimum grade of C. Lecture, 3 hours; laboratory, 4 hours.</i> A basic understanding of the acquisition and nature of satellite imagery and the tools required to process data from remote sensing systems. Topics include spectral and spatial enhancement, image classification, geometric and radiometric correction, with emphasis on applications. Lab: Analysis of Landsat and SPOT digital image data using image processing software.
GEOG 115C , Intermediate Remote Sensing Techniques	5	Bookhagen, McFadden Prerequisite: <i>Geography 115B with a minimum grade of C.</i> <i>Lecture, 3 hours; laboratory, 4 hours.</i> Examines information extraction and radiative transfer relevant to remote sensing, focusing on applications for environmental monitoring and natural resource management. Lab exercises develop skills for advanced processing of satellite data, including linear transforms, image correction, and change detection. Both commercial and public-domain software packages are employed.
GEOG 126 , Maps in Science and Society	4	Clarke Prerequisite: <i>Consent of instructor.</i> Recommended Preparation: <i>Geog 12</i> The growth of geodesy, printing, and technology; exploration of the earth and near planets; topographic surveys and photogrammetry; LANDSAT; relation of contemporary thematic cartography to statistics and graphic science.
GEOG 128 , Analytical and Computer Cartography	4	Clarke Prerequisite: <i>Geog 12.</i> <i>Lecture, 3 hours; laboratory, 2 hours.</i> Using computers to create and analyze maps. Coding, storing and representing geographical data.

		Accessing spatial data over the internet. Map data structures and transformations. Design and programming issues in map production.
GEOG 134 , Earth System Science	4	Gautier/King <i>Prerequisite: Geography 3A or Geography 8.</i> <i>Recommended Preparation: Two prior upper-division courses in physical geography.</i> <i>Lecture, 3 hours; laboratory, 2 hours.</i> Description of various components of earth system: climate and hydrologic systems, biogeochemical dynamics, ecological dynamics, human interactions, and global change with an emphasis on the climate components. Observations and modeling of earth system.
GEOG 140 , Environmental Impacts in Human History	4	Roberts <i>Prerequisite: Upper division standing and consent of instructor.</i> <i>Recommended Preparation: Geography 3A or 3B; and Geography 5.</i> <i>Lecture, 3 hours; discussion, 1 hour.</i> Interactions between human history and the environment are explored. Example topics include early Earth history, long term climate change, the origin of agriculture, short term climate change, the origin of importance of disease and invasive species.
GEOG 141B , Population and Development	4	SWEENEY <i>Prerequisite: Geography 141A.</i> A survey of global and regional patterns of demographic change and their connection to significant economic development issues. Basic methods of demographic analysis are introduced to study historical and current issues in population and development.
GEOG 145 , Society and Hazards	4	Staff <i>Prerequisite: Upper-division standing or consent of instructor.</i> <i>Open to non-majors.</i> Presents geographic approaches to the study of environmental hazards, exploring the evolution of theory and key concepts, causal processes, trends and patterns in the spatial distribution of vulnerability
GEOG 146 , Introduction to Transportation	4	Church <i>Prerequisite: Geography 5.</i> Introduction to the analysis of inter- and intra-city passenger and freight movements. Geographic and economic concepts are used to develop predictive and optimal design/maintenance models for the transportation system. Applications of the model are stressed.
GEOG 148 , California	4	Michaelsen <i>Notes: Lecture, 3 hours.</i> The unique landscapes of California and the physical, cultural, and biotic processes which have produced them.
GEOG 150 , Geography of the United States	4	Montello <i>Prerequisite: Not open to freshmen</i> <i>Notes: Lecture, 3 hours.</i> Intensive study of the physical and cultural processes that have shaped and are shaping the landscapes of the U.S.
GEOG 153A , Behavioral Geography	4	Montello <i>Prerequisite: Geography 5</i> <i>Lecture, 3 hours; laboratory 1 hour.</i> This course examines aspects of the human-environment interface, emphasizing behavioral processes in spatial contexts including spatial choice and decision making, consumer behavior, migration and other episodic movements, time budgets, spatial cognition, and cognitive mapping.
GEOG 153B , Introduction to Spatial Decision Making and Behavior	4	Staff <i>Recommended Preparation: Geography 5</i> Gateway for the spatial decision making and behavior field. Includes environmental cognition; consumer spatial behavior; migration; space-time budgeting; destination and mode choice; risk and hazard perception; spatial preference. Laboratory sessions involve locational and city management simulation games.
GEOG 153C , Environmental Perception and Cognition	4	Montello <i>Prerequisite: Geography 5.</i> Research and theory on human perception and cognition of environments. Topics include spatial perception, spatial learning, knowledge structures, navigation and wayfinding, language and spatial cognition, map use, the spatial skills of special populations, and other issues.
GEOG 153D , Spatial Decisions in Retailing	4	Church/Goodchild <i>Prerequisite: Geography 5 or consent of instructor</i> Applications of spatial decision-making and behavior to retail systems: site selection, site evaluation, trade area estimation, spatial dimensions of retailing, and bricks vs. clicks retailing.
GEOG 155 ,	4	Carr

Geography of Latin America		Prerequisites: <i>Geography 5 or Global Studies 1 or 2 or Environmental Studies 1 or 2 or 3.</i> El Pueblo, a vila, li tenamit: whatever you call where you live, geography matters. Why are human and physical patterns inscribed where they are on the Latin American landscape? And what are the economic, political, social, and environmental causes and consequences of human-environment interactions across the diverse region of Latin America?
GEOG 159, Geography of Europe	4	Couclelis Prerequisites: <i>Upper division-standing or consent of instructor</i> A systematic approach to the study of the human and physical resources of Europe. Special emphasis placed on the spatial aspects of urban, economic, and social processes.
GEOG 161, World Agriculture, Food, and Population	4	Cleveland Prerequisite: <i>Upper-division standing.</i> Enrollment Comments: <i>Same course as Anthropology 149 and Environmental Studies 149.</i> Evolution, current status, and alternative futures of agriculture, food and population worldwide. Achieving environmentally, socially, and economically sustainable food systems; soil, water, crops, energy and labor; diversity, stability and ecosystems management; farmer and scientist knowledge and collaboration; common property management.
GEOG 172, Intermediate Geographical Data Analysis	5	Kyriakidis Prerequisites: <i>PSTAT 5AA-ZZ or EEMB 30 or Psychology 5 or Communication 87.</i> Statistical analysis of geographical data. Topics include spatial auto-correlation, multiple regression in a spatial context, and introductory methods for the statistical analysis of point, area (lattice) and continuous spatial data. Lab includes the use of statistical software for carrying out analyses of various spatial data types.
GEOG 176A, Introduction to Geographic Information Systems	4	Clarke Recommended Preparation: <i>Geography 12.</i> Comprehensive overview of Geographic Information Systems and Science. Topics include geographic data collection, modeling, and representation; geographic databases; cartographic issues; spatial queries; mobile GIS and GI Services; cognitive and social aspects. Labs provide hands-on experience with GIS software.
GEOG 176B, Technical Issues in Geographic Information Systems	5	TBA Prerequisites: <i>Geography 176A with a minimum grade of C; concurrent enrollment in Geography</i> Study of the technical issues underlying Geographic Information Systems, including coordinate systems and analytic geometry, database models and structures, algorithms and analytical procedures
GEOG 176C, GIS Design and Applications	5	Clarke Prerequisite: <i>Geography 176B with a minimum grade of C.</i> Applying GIS theory and techniques to solve spatial problems in land and resource management, utilities, and municipal government. Lectures cover all stages of a GIS project, e.g., planning, design, analysis, and presentation of results. In labs, students collaborate in groups to design, develop, and present a GIS pilot study.
GEOG 182, Global Cities in the Information Age	4	Couclelis Prerequisites: <i>Geography 5.</i> Study of the economic, social, and political networks that link together cities of global importance. Specializations and roles of global cities in the information age economy. Examination of individual cities at the top tiers of the global urban hierarchy.
GEOG 183, Cartographic Design and Geovisualization	4	Clarke Prerequisite: <i>Geography 12 or 176A.</i> Technical introduction to graphic representation and visualization of geographic information. Lectures cover static and dynamic design aspects, thematic mapping, interface design, animation, and 3D. Labs provide hands-on experience in designing thematic maps and constructing basic GeoVis tools with current software.
GEOG 184A, Introduction to Cartographic Programming	4	Clarke Prerequisite: <i>Computer Science 5AA-ZZ and Geography 12.</i> <i>Lecture, 3 hours; laboratory, 4 hours.</i> Introduces the student to cartographic programming principles. Instruction will emphasize structured decomposition, device independence, and reusability in cartographic software. Lab work will provide students with hands-on experience with implementing a reusable cartographic library.
GEOG 185A, Geography Planning and Policy Making	4	Couclelis Prerequisites: <i>Geography 5 or Environmental Studies 116.</i> Relevance of geographic knowledge and skills to aspects of planning and policy making. Includes review of core concepts in decision making, planning theory, systems analysis, information systems, urban and regional modeling, forecasting, impact analysis, implementation of decisions, planning policies.
GEOG 185B,	4	Church

Environmental Issues and Location Decision Making		Prerequisites: <i>Geography 3A or 3B or 5 or Environmental Studies 135A.</i> <i>Taught spring quarter every year.</i> Introduction to decision making techniques with regard to land use allocation and planning. Special emphasis on addressing conflicts involving environmental concerns and multiple objectives. Examples involving water resources development, corridor location (rights-of-way, e.g., transmission lines), preservation of endangered species, disposal of solid waste, and power plant siting are presented.
GEOG 191, Introduction to Optimization Methods for Geographic Problems	4	Church Prerequisite: <i>Mathematics 3A, or 34A; upper-division standing.</i> <i>Offered in winter of even-numbered years. Lecture, 3 hours.</i> Introduction to “Operations Research” methods that are used in the analysis of geographic problems, including linear programming, network programming, integer programming, and dynamic programming. Example problems involving spatial temporal decision making are emphasized.
GEOG 191L, Laboratory in Optimization Methods for Geographic Problems	1	Church Prerequisite: <i>Geography 191 (may be taken concurrently). Laboratory, 1 hour.</i> Computer laboratory utilizing special optimization programs and computer graphics devices.
HIST 106C, History of Modern Science	4	Staff Prerequisite: <i>History 4A or 4B or upper-division standing.</i> Science in the late 19th and 20th century with emphasis on the physical sciences. Topics include: end of classical physics; x-rays and radioactivity; quantum revolution; astronomy and cosmology; nuclear physics; the integration of scientists into the national security state.
HIST 107G. History of Global Environmental Problems	4	STAFF Prerequisite: <i>Environmental Studies 1, or one course from History 4A-B-C, 106A-B-C, 107A-B-C.</i> Enrollment Comments: <i>Same course as Environmental Studies 107.</i> Survey of global environmental problems from antiquity to the present. Topics include demography, agriculture, climate change, disease, and storage of toxic waste.
HIST 176A/B, The American West	4-4	Staff Prerequisite: <i>a lower-division course in history or upper-division standing.</i> The West as a frontier and as a region, in transit from the Atlantic seaboard to the Pacific, and from the seventeenth century to the present.
HIST 178A. American Urban History	4	O'CONNOR Prerequisite: <i>Any two quarters of History 17A-B-C or upper-division standing.</i> A study of the political, economic, social, and intellectual impact of the city upon American history, and the impact of history upon the growth of American urbanization.
LING 117. Regional Dialects and Varieties of English Around the World	4	KENNEDY Prerequisite: <i>Linguistics 20.</i> Offers a comprehensive and in-depth survey of regional dialects of English throughout America and around the world. Examines dialect variation through both descriptive analysis as well as socio-historic accounts of the emergence of particular varieties.
LING 181, Languages of the World	4	Comrie Introduction to the languages of the world: Geographical distribution; genetic (genealogical) classification, including comparison with genetics and archeology; structural properties and sociolinguistics of selected languages representing different parts of the world.
MATH 102A-B, Modern Euclidean and Noneuclidean Geometry	4-4	Staff Prerequisites: <i>Mathematics 3B (for 102A): Mathematics 102A (for 102B).</i> Especially suitable for prospective teachers. Topics in plane and solid geometry. The axioms of pure, Euclidean, projective, and noneuclidean geometry. Transformational geometry (isometries, dilations, involutions, perspectivities, and projectivities). The history and the historical implications of these developments in geometry.
MATH 108A, Introduction to Linear Algebra	4	Staff Prerequisites: <i>Mathematics 5A and 8.</i> Abstract Vector spaces and subspaces. Span and linear independence. Basis and dimension. Linear maps. Eigenvalues and eigenvectors.
MATH 108B, Introduction to Linear Algebra	4	Staff Prerequisite: <i>Mathematics 108A.</i> Diagonalization, inner product spaces, projections, least-squares approximations, invariant factors and elementary divisors, canonical forms, topics from advanced matrix theory, applied linear algebra, and group representation theory.
MATH 113, Non-	4	Staff

Euclidean Geometry		Prerequisite: <i>Mathematics 8.</i> An introduction to hyperbolic geometry with some discussion of other non-Euclidean systems.
MATH 137A-B, Graph and Network Theory	4-4	Staff Prerequisites: <i>Mathematics 5A and 8 (for Mathematics 137A): Mathematics 137A (for Mathematics 137B).</i> Elements of graph and network theory including paths, circuits, trees, coloring, planarity, matching theory, Hall's Theorem, applications to scheduling theory, flows in networks, Menger's Theorem, and other topics as time permits.
MATH 145, Introduction to Topology	4	Staff Prerequisite: <i>Mathematics 8.</i> Metric spaces, continuity, compactness, classification of surfaces, Euler characteristics, and fundamental groups. Additional topics at the discretion of the instructor.
MATH 147A-B, Introductory Differential Geometry	4-4	Staff Prerequisites: <i>Mathematics 5B; and, Mathematics 108A or 117 (for Mathematics 147A): Mathematics 147A (for Mathematics 147B).</i> Curves and surfaces in three-dimensional Euclidean space, first and second fundamental forms, Gaussian and mean curvature, geodesics, Gauss-Bonnet theorem, and non-euclidean geometry.
MATRL 100A, Structure and Properties I	3	Seshadri/Spaldin Prerequisites: <i>Chemistry 1A-B; Physics 4; and, Mathematics 5A-B-C.</i> An introduction to materials in modern technology. The internal structure of materials and its underlying principles: bonding, spatial organization of atoms and molecules, structural defects. Electrical, magnetic, and optical properties of materials, and their relationship with structure.
MATRL 101, Introduction to the Structure and Properties of Materials	3	Staff Prerequisite: <i>upper-division standing.</i> <i>Not open for credit to students who have completed Materials 100B.</i> Introduction to the structure of engineering materials and its relationship with their mechanical properties. Structure of solids and defects. Concepts of microstructure and origins. Elastic, plastic flow and fracture properties. Mechanisms of deformation and failure. Stiffening, strengthening, and toughening mechanisms.
MCDB 149. Mariculture for the 21st Century: Research Frontiers	4	STAFF Prerequisite: <i>Upper-division standing.</i> Enrollment Comments: <i>Not open for credit to students who have completed Biology 149. Same course as EEMB 149.</i> Recent progress and new directions in research increasing production of valuable marine animals, plants, and microorganisms. Control of reproduction, development, growth and disease in marine species; problems encountered in commercializing production; regional and biological solutions; the role of modern biotechnology.
MCDB 151, Neurobiology I: Cellular Organization and Biophysics of the Nervous System	4	Vandenberg, Ma Prerequisites: <i>MCDB 1A and 1B. Completion of both prerequisites with a grade of C or better.</i> <i>Not open for students who have completed Biology 105 or MCDB 114. Lecture, 3 hours; discussion, 1 hour.</i> Properties of the nervous system ranging from single cells to the whole organism, using examples from vertebrates and invertebrates studied in terms of morphology, physiology, and behavior.
MCDB 152, Neurobiology II: Molecular and Cellular Neurobiology	4	Kosik/Clegg Prerequisites: <i>MCDB 1A-1B and MCDB 151; completion of all prerequisites with a grade of C or better.</i> <i>Lecture, 3 hours; discussion, 1 hour.</i> This second course of a three quarter neurobiology course sequence (151/152/153) covers both top down systems level approaches and bottom up molecular approaches to major topics in neurobiology. These topics include mechanisms of sensory transduction in at least two selected sensory systems, processing of sensory information within the brain, mechanisms of muscle control, cell signaling, neuronal plasticity, neuronal polarity, and the mapping of neural information to the brain.
MUS 160F, Sound Color: Timbre and Music Notation	3	Staff Prerequisites: <i>consent of instructor; not open to freshmen.</i> "Sound color" refers to the quality or timbre of musical sound, whether instrumental, vocal, or synthetic. This course investigates timbre's special perceptual and cognitive qualities, as well as its unique expressive power in music.
MUS 168I, Film Music Cognition	4	Staff Prerequisite: <i>Music 11 or Music 5A (may be taken concurrently); upper division standing or consent of instructor.</i> Concurrently offered with Music 262I. A consideration of film music as a medium of communication between the director, composer, music supervisor, editors, performers, and the audience. Emphasis given to cognitive psychological theories of

		meaning in terms of structure and affect in audio/visual contexts.
MUS 169 , Notation and Transcription in Ethnomusicology	3	Staff Survey of existing notational systems and exercises in ethnomusicology and transcription, with particular attention to issues related to the visual representation of performed musical sound.
MUS 174 , Musical Acoustics	4	STAFF Prerequisite: <i>Upper-division standing; Music 11 or Music 5A (which may be concurrent).</i> Enrollment Comments: <i>Lower division students can enroll with consent of instructor.</i> Consideration of the relationships between acoustics, perception and music. Emphasis on the physical and psychophysiological bases for tonality, dynamics, timbre and rhythm. Additional focus on the vibrational properties of musical instruments and features of digital recording and playback.
PHIL 124C , Philosophy of Space and Time	4	Staff Prerequisite: <i>a prior course in philosophy.</i> <i>May be repeated for credit up to 8 units with consent of instructor.</i> Recommended preparation: <i>a strong background in physics.</i> Is space a thing or a series of relations holding between objects? Does time pass differently for different observers, or in different parts of the universe? Consideration of these and other questions lead to an examination of contemporary physics.
PHYS 103 , Intermediate Mechanics	4	STAFF Prerequisite: <i>Physics 1, 2 and 3 or Physics 20, 21 and 22; Mathematics 6B (may be taken concurrently).</i> Newtonian mechanics in 3D. Conservation laws. Simple harmonic oscillator (undamped, damped, driven and nonlinearities). Central force motion (orbits, Kepler's laws). Collisions (elastic, inelastic, scattering, cross sections). Special relativity.
PHYS 106 , Nonlinear Phenomena	4	Staff Prerequisites: <i>Physics 105A; or ME 163; or upper-division standing in ECE.</i> <i>Same course as ECE 183 and ME 169. Not open for credit to students who have completed ME 163C.</i> An introduction to nonlinear phenomena. Flows and bifurcations in one and two dimensions, chaos, fractals, strange attractors. Application to physics, engineering, chemistry, and biology.
PHYS 131 , Gravitation and Relativity	4	Staff Prerequisites: <i>Physics 105A-B with a minimum grade of C-.</i> <i>Physics 105B may be taken concurrently only with the consent of the instructor.</i> An introduction to Einstein's general relativity. The spacetime of special relativity, the principle of equivalence, gravity as geometry, the description of spacetime geometry, the spacetime of a relativistic star, solar system tests of general relativity, gravitational collapse, black holes, cosmology.
PHYS 133 , Galaxies and Cosmology	4	Staff Prerequisite: <i>Physics 5 or 25.</i> Observed properties of galaxies, the interstellar medium, stellar dynamics, spiral arms, galaxy clusters, dark matter, quasars, the Hubble expansion, Friedmann models, thermal history of the universe, the origin of the light elements, the cosmic microwave background structure formation.
PHYS 141 , Optics	4	Staff Prerequisite: <i>Physics 5 or 25.</i> Modern geometrical and physical optics. Polarization, coherence, interference, and diffraction phenomena. Fourier transform spectroscopy, intensity correlation interferometry, spatial filtering, and holography. Selected topics on lasers, light scattering, and quantum optics as time permits.
PSTAT 123 , Sampling Techniques	4	Staff Prerequisites: <i>PSTAT 120A-B.</i> An elementary development of the statistical methods used to design and analyze sample surveys. Basic ideas: estimates, bias, variance, sampling and nonsampling errors; simple random sampling with and without replacement; ratio and regression estimates; stratified sampling; systematic sampling; cluster sampling; sampling with unequal probabilities, multistage sampling. Examples from various fields will be discussed to illustrate the concepts including sampling of biological populations, opinion polls, etc.
PSTAT 131 , Data Mining	4	Staff Prerequisites: <i>PSTAT 120A-B, 126, 130.</i> Introduction to data mining techniques. Model assessment and performance evaluation. Data preparation. Programming techniques for transforming raw data into a form suitable for predictive modeling. Extracting data to a form that predictive models can utilize. Incorporating non numeric data in predictive models. Techniques for managing exceptional and extreme data. Building predictive models using SAS Enterprise Miner 5 in SAS 9, including decision trees and neural networks.
PSTAT 160A-B , Applied Stochastic Processes	4-4	Staff Prerequisites: <i>Mathematics 5A and 8; PSTAT 120A with a minimum grade of C.</i> Random walks, Markov chains, Poisson processes, Markov processes; second order processes, Wiener process stochastic differential equations, optimal prediction, spectral distributions; queueing theory,

		simulation and applications to mathematical finance.
PSTAT 174 , Time Series	4	Staff <i>Prerequisites: PSTAT 120A-B.</i> Stationary and non-stationary models, seasonal time series, ARMA models: calculation of ACF, PACF, mean and ACF estimation. Barlett's formula, model estimation: Yule-Walker estimates, ML method, identification techniques, diagnostic checking forecasting, spectral analysis, the periodogram. Current software and applications.
PSY 107 , Introduction to Perception	4	Loomis <i>Prerequisite: Psychology 1 or upper-division standing.</i> <i>May not be taken after or concurrently with Psychology 110A or 110B or 110C or 110L or 118A.</i> An introductory course in perception open to students in all majors. A variety of demonstrations are used to allow the student to experience the phenomena of perception. Current hypotheses and theories concerning the underlying psychological and biological processes are described.
PSY 108 , Introduction to Cognitive Psychology	4	Hegarty/Revlín <i>Prerequisite: Psychology 1 or upper-division standing.</i> An elementary course in such topics as pattern recognition and attention, memory, language, reasoning, and problem solving.
PSY 110A , Perception: Vision	4	Eckstein <i>Prerequisites: Psychology 1, 5, and 7; open to psychology, biopsychology and interdisciplinary studies majors only.</i> Overview of visual perception. Course covers a wide range of phenomena from the detection of simple stimuli to the identification of objects and events. Human performance, psychological theories, and biology are considered. <i>Note: Students in Spatial Studies Minor require consent of instructor.</i>
PSY 110B . Perception: Audition	4	ASHBY, ECKSTEIN <i>Prerequisite: Psychology 1, 5, and 7; open to psychology, biopsychology and interdisciplinary studies majors only.</i> <i>Enrollment Comments: May not be taken concurrently with Psychology 107.</i> An overview of auditory perception covering topics such as the physics of sound, psychophysical methods, the structure and function of the ear and auditory pathway, detection and discrimination, masking, pitch performance, psychological theories, and biology will be considered. Perception, musical scales, 3-D localization, and speech perception.
PSY 128 , Human Thinking and Problem Solving	4	Hegarty/Mayer <i>Prerequisite: Psychology 1, 5, and 7; open to psychology, biopsychology, and interdisciplinary studies majors only.</i> <i>Recommended preparation: Psychology 108.</i> An examination of theories and supporting evidence regarding the nature of human thought processes. <i>Note: Students in Spatial Studies Minor require consent of instructor.</i>
PSY 156 . Multimedia Learning	4	MAYER <i>Prerequisite: Psychology 1, 5, and 7; open to psychology, biopsychology, and interdisciplinary majors only.</i> An introduction to research and theory on how people learn from words (such as spoken text or printed text) and graphics (such as pictures, diagrams, video, or animation), with a focus on evidence-based principles for designing effective multimedia presentations.
RG ST 116C . Archaeology and the Study of Religion	(4)	THOMAS <i>Prerequisite: Any lower or upper-division course in Religious Studies</i> An examination of the uses of archaeological materials to reconstruct the history of religions in the ancient world, with special attention to the relationships between material culture, religious iconography, epigraphy, and sacred texts.
RG ST 128C , The Sacred Geography of the Ancient Mediterranean World	4	Thomas A survey of religious sites in polytheism and early Christianity. After general introduction to the sites, the topos of sacred space and ritual, and the methods of secondary research for archaeological materials, students produce audiovisual presentations in seminar format.
SOC 126 , Urban Society	4	Staff Problems of the city, (e.g., congestion, homelessness, violence) are examined in light of larger economic and social forces which structure urban life. Through use of slides depicting urban settings, causes and consequences of different ways urban settlements have been organized are considered.
SOC 148MA ,	4	Friedkin

Social Network Analysis	<i>Prerequisite:</i> upper-division standing. Introduction to concepts, methods, and applications of social network analysis.
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