GEOG 390-1
Area BB

California State University, San Marcos FORM UDGE-BB (WHITE)

UPPER DIVISION GENERAL EDUCATION NEW COURSE PROPOSAL
FOR AREA BB – MATHEMATICS/QUANTITATIVE REASONING OR PHYSICAL AND LIFE SCIENCES

Please Read Instructions on Next Page of This Form

Course Number: GEOG 310 or GEOG 390 (topics course)
Course Title: Climate Change and Life in the Anthropocene

XX This is a new course. Both a FORM C and a Form T are being filed concurrently.

o This is an existing course not currently satisfying an UDGE requirement, which is not being changed.

o This is an existing course not currently satisfying an UDGE requirement, which is undergoing change. A FORM C-2 is being filed concurrently.

o This is an existing course currently satisfying an UDGE requirement which is being submitted for recertification. *A FORM C-2 is required only if the course is being changed.*

1. Please attach a syllabus or draft syllabus of the course.

2. How many units is this course? 3 (Upper-Division General Education courses are limited to 3 units.)

3.a. Does this course have (a) prerequisite (s) other than completion of LDGE requirements?

___yes XX no

b. Does this course fulfill requirements for a major by the academic unit in which the course is offered? Check the YES box even if the course counts as an elective in the major.

___yes XX no

c. If you answered "yes" to 3.a. or 3.b., then the course is an exception to the definition printed on the next page of this form, and you must explain why the GE committee should make an exception for this course. Please describe how this course is designed to provide valuable and appropriate learning experiences to both majors and non-majors.

Read Questions 4-7 in the instructions on the next page of this form and submit your answers as attachments. The instructions do not have to be printed or submitted.

Signatures

Originator	Date 07Feb2017
Program Director	Date 2/7/17
General Education Coordinator	Date
General Education Committee Chair	Date

Tracker ✓
GE_RP ___
PS ___

4. Upper division general-education students may have fulfilled their lower division area B requirements in broad, interdisciplinary courses or in a different discipline than the discipline in which this course is offered. Please explain how this course introduces such students to the basic assumptions, principles and methods of the discipline, and how connection is made between these fundamentals and the particular applications emphasized in the course.

Climate science is interdisciplinary in nature, building on and contributing to research in areas like physics, chemistry, geology, oceanography, and sub-disciplines that examine past climate systems and landscapes. The course examines the foundational concepts and their contributions to building a complex, global scale model of the Earth's present climate system prior to examining the processes that contribute to changes in climate. Students build upon, and utilize their previous knowledge, to examine specific components of climate change (e.g., energy receipt at the Earth's surface changing with Milankovitch cycles and how this influences climate). As the semester progresses, students create increasingly complex visualizations and models, continuously incorporating new components to understand interaction and feedback in the Earth's climate system. Near the end of the semester, the students construct projections of future climate, to demonstrate and discuss the role of humans as agents of, and victims to, global-scale change.

5. Please specify how the course requires students to use reasoning skills characteristic of common scientific and mathematical practice to do one or more of the following: to solve problems, to interpret observations, to make predictions, to design experiments for the testing of hypotheses, or to prove theorems. Examples given should illustrate how these skills are used throughout the course.

Students spend time each class engaged in at least one aspect of scientific and/or mathematic practice. The weekly activities or case studies ask students to develop questions and hypotheses, perform experiments or create models, and to write and explain outcomes. To examine one aspect of Earth-Sun relationships and Earth's energy budget, students examine the correlation between distance from the energy source, and the intensity of energy received at a surface. From their calculations (and observations), students are asked to create a hypothesis (a mathematical equation, in this case) that explains the relationship. Students then calculate predicted intensities of energy receipt for specific distances from an energy source. They then test their hypothesis. From their results, they can "scale up" to discuss the relationship between solar output and Earth's energy receipt as an average, as well as seasonal and long-term (millennial) changes in the Earth's orbit. This set of small experiments, measurements, and calculations provides a hands-on approach that lead to discussions about changes in climate at various temporal scales.

6. Please specify how both past successes and current uncertainties in science or mathematics are well represented in the course, in order that the cumulative, historical nature of the development of science and mathematics can be illustrated. Give examples covered in the course of (a) older, well-established laws and theories that are no longer debated in scientific and mathematical circles, and (b) issues where either fundamental questions remain unanswered or where the application of well-established principles to new situations carries some uncertainty or controversy.

The second week of this course begins with reading from Arrhenius (1896), who described the relationship between carbon dioxide and atmospheric temperature. This particular relationship is well established and climate scientists understand that past warming trends are generally initially related to changes in Milankovitch Cycles (Week 9), causing oceans and permafrost to release CO_2 and amplify the warming trend, accounting for a large proportion of the warming trend (feedback loops; Week 5). Climate scientists describe paleoclimates where both temperatures and CO_2 levels were greater than today; however *Homo sapiens* were not part of those environments, particularly in our current forms of society (Week 8). What is uncertain is not the relationship between CO_2 and warming trends, but the impacts of the warming trends on different populations across the planet, including other species. This uncertainty plays into discussions on energy use, political approaches (treaties), and adaptation and mitigation efforts (Weeks 11-15), but instead center on discussions on the roles of CO_2 or humans as climate change drivers.

7. a. Please give examples explaining how the work assigned to students (quizzes, tests, essays, projects, etc.) allows you to measure how successful individual students are in meeting the UDGE learning objectives for this course. Please attach an example of the type of assignment you will use to evaluate how successfully students meet the UDGE learning objectives.

Each week students will work on case studies and experiments. The example activity attached asks students to investigate Earth-Sun relationships. Students first investigate how solar energy intensity varies with distance from Sun through a simple experiment where they collect data and then evaluate the correlation between distance and intensity. This activity then builds to test their hypothesis on the distance/intensity relationship. Their results are then applied to the Earth system, to evaluate how the Earth's changing orbital shape could influence solar intensity. Students then investigate the relationship through Earth's seasonal cycles. This lab meets CLOs 3 and 4 and GEPSLOs 1-4.

b. If you use any course assessment activities (e.g., "pre" and "post" testing, class-wide analysis of individual test questions, etc.) that measure whether or not the class as a whole successfully meets the General Education learning objectives for this course, please attach examples of these as well.