Cover Sheet: Request 12550

IUF2100 CLIMATE CHANGE SCIENCE AND SOLUTIONS

Info

Process	Course|Modify|Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Andrew Zimmerman azimmer@ufl.edu
Created	4/16/2018 3:58:36 PM
Updated	4/19/2018 12:43:16 PM
Description of request	Change IUF2100 to IDS2100 as requested by Associate Provost Lindner: In response to the Higher Education Bill's striking the ability of preeminent institutions from having a unique course, we will need to submit a request to change the IUF prefix of IUF1000 and IUF2100 to IDS. This will begin our transition to the fully envisioned UF Quest program as new courses come on board.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	CLAS - Geological Sciences 011610000	David Foster		4/16/2018
CCSS_FA17_syllabus_IUF2100.pdf					4/16/2018
College	Approved	CLAS - College of Liberal Arts and Sciences	Joseph Spillane		4/19/2018
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			4/19/2018
No document changes					
Statewide Course Numbering System					
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Course|Modify for request 12550

Info

Request: IUF2100 CLIMATE CHANGE SCIENCE AND SOLUTIONS
Description of request: Change IUF2100 to IDS2100 as requested by Associate Provost Lindner: In response to the Higher Education Bill's striking the ability of preeminent institutions from having a unique course, we will need to submit a request to change the IUF prefix of IUF1000 and IUF2100 to IDS. This will begin our transition to the fully envisioned UF Quest program as new courses come on board.
Submitter: Andrew Zimmerman azimmer@ufl.edu
Created: 4/16/2018 3:49:20 PM
Form version: 1

Responses

Current Prefix IUF
Course Level 2
Number 100
Lab Code None
Course Title CLIMATE CHANGE SCIENCE AND SOLUTIONS
Effective Term Earliest Available
Effective Year Earliest Available
Requested Action Other (selecting this option opens additional form fields below)
Change Course Prefix? Yes
Current Prefix IUF
Proposed Prefix IDS
Change Course Level? No

Change Course Number? No

Change Lab Code? No

Change Course Title? No

Change Transcript Title? No

Change Credit Hours? No

Change Variable Credit? No

Change S/U Only? No

Change Contact Type? No

Change Rotating Topic Designation? No

Change Repeatable Credit? No

Maximum Repeatable Credits 0
Change Course Description? No

Change Prerequisites? No

Change Co-requisites? No

Rationale This change is a request from Associate Provost Angela Lindner.

From Dr. Lindner: "In response to the Higher Education Bill's striking the ability of preeminent institutions from having a unique course, we will need to submit a request to change the IUF prefix of IUF1000 and IUF2100 to IDS. This will begin our transition to the fully envisioned UF Quest program as new courses come on board. We need to make sure this is approved by SCNS by June ."

SYLLABUS: CLIMATE CHANGE SCIENCE AND SOLUTIONS
Fall 2017 IUF2100

Meeting: MAEB 229, Thursday 6th-7th period (12:50-2:45 pm)

INSTRUCTORS

Lead Instructor: Dr Andrew Zimmerman, Department of Geological Sciences
Office: 364 Williamson Hall Ph# 392-0070 e-mail: azimmer@ufl.edu Office meeting: by appointment

TA: Julie Emminger Office ARC313
Office Hours: Tues. 1:50 – 2:45 pm (or by appt.) e-mail: jcemminger@ufl.edu

COURSE DESCRIPTION

This course invites students to deepen their understanding of the practice of science by examining the complex issue of climate change. Working collaboratively and using the scientific method, we will explore the multi-disciplinary evidence behind climate change and its effects and develop potential novel adaptation and mitigation solutions and to communicate this work effectively.

Prerequisites: none **Credits:** 3 **Course Fee:** none **Gen. Ed. Fulfillment:** P

Course Objectives
This physical science general education course will cover concepts of climate change and science in our modern and global society. It is the aim of this course that by the end, students will be able to:

- Understand the basic facts and uncertainties regarding climate change and the role of humans in causing it.
- Understand how climate change affects natural and human systems and how these effects vary across nations and with socioeconomic factors and cultures worldwide.
- Apply the process of critical thinking and scientific inquiry in discovering, understanding, and addressing the challenges of climate change.
- Develop hypothesis-driven solutions to address climate change through critical evaluation and teamwork.
- Effectively communicate multi-disciplinary scientific challenges and strategies for addressing them.

Course Structure
The course will require both on-line and in-class participation. Each week, students will cover online content on their own time (about 2 hours total) that will include:

1) Completion of a 'Spark' Discussion (See due date in 'Weekly CCSS Due Dates' at end of syllabus)
2) Readings and on-line lectures
3) A quiz on the on-line materials (See due date in 'Weekly CCSS Due Dates' at end of syllabus)

Each week, in class, students will:

1) Take a team readiness assurance-test (t-RAT) and review on-line material
2) Complete an In-Class Activity that reinforces the 'Fundamental Science Topic' & 'Framework Topic'. This is usually a group activity that will be turned in (via Canvas, one per group) by the end of the class meeting day.

In addition, students will work on a semester-long group project, both in and outside of class, which will, via hypothesis testing and quantitative analysis, develop a novel approach to addressing one a climate change-related problem. Students are required to bring a laptop or other web-enabled device (though use of a smart phone is not advised). Students are also required to participate in a midterm exam one evening of the semester.

COURSE WEBSITE and COMMUNICATION

Course Website

The course will run via **Canvas** (UF https://ufl.instructure.com/). The course site will be used to post relevant announcements, reading, lecture materials, links, assignments and quizzes, etc. You are responsible for checking this site for updates, announcements and to verify that your grades are recorded correctly. No grade will be changed more than one week following the due date for the assignment. It is recommended that students adjust Canvas settings so that Announcements are sent to phone or email. All communication with instructors should use the mail tool within this site.

Questions in regards to grades etc (e.g. medical emergency, legal, documented disability accommodation, etc.) should be sent to the TA who will forward these to the faculty instructor as necessary.

Required Textbook

Dire Predictions: Understanding Global Warming, by Mann and Kump, 2015, Pearson, 2nd edition ($16 new on Amazon, Kindle or at the UF bookstore for about $39). In addition, there will be numerous selected readings posted or linked through the course website weekly.

ASSESSMENTS AND GRADING

Final Grade Calculation

15%	Homework (individual):		
	3%	12 'Spark' Discussions (2 lowest dropped)	[0.3% = 3 pts each, 30 tot.]
	12%	12 Quizzes (2 lowest dropped)	[1.2% = 12 pts each, 120 tot.]
10%	In-class Quiz (group t-RAT), 12 quizzes, 2 lowest dropped		[1% = 10 pts each, 100 tot.]
25%	In-class Activities (group) 12 assignments, 2 lowest dropped		[2.5% = 25 pts each, 250 tot.]
5%	In-class Attendance (+homework, individual)		[50 pts. total]
30%	Final Project (group)		
		Initial Proposal (group assessment)	[3% = 30 pts]
		Hypothesis/Source (group assessment)	[3% = 30 pts]
		Quant. Method (group assessment)	[5% = 50 pts]
		Final Presentation (group assessment)	[8% = 80 pts]
		Final Paper (group assessment)	[8% = 80 pts]
		Effort (individual/team assessment)	[3% = 30 pts]
15%	Mid-term Exam* (Curved to a median of 85%, No Final Exam)		[15% = 150 pts]

Final Grade Scale

A = ≥93%, A- = 90-92.99, B+ = 87-89.99, B = 83-86.99, B- = 80-82.99, C+ = 77-79.99, C = 73-76.99, C- = 70-72.99, D+ = 67-69.99, D = 63-66.99, D- = 60-62.99, E < 60

***Note:** The midterm exam scores will be curved to a median of 85% using a linear method described here: http://www.ats.amherst.edu/software/excel/excel-grading/excel-grades/#CurvingGrades

***Note:** A grade of 'C-' or below does not qualify for major, minor, Gen. Ed., or college basic distribution credit.

Discussions

Students have 2-3 days from the end of class (See due date in 'Weekly CCSS Due Dates' at end of syllabus) to complete the on-line 'Spark' Discussion. Each student must make one substantive original comment and one substantive response to the comment of another student. That is, students must read what has been said before and add something more than a few words of agreement or disagreement. No credit will be given for late submissions.

Quizzes and Exams

Each week students must complete a time-limited (30 min.) quiz on Canvas by midnight of the day before class consisting of 12 multiple choice questions (open book) on all lecture and reading materials presented on-line that week. These quizzes cannot be made up or taken late if missed except in the case of an excused absence. (At 11:59 pm, the quiz will lock students out and unanswered questions will be marked wrong. So start by 11:30 p.m.)

At the start of class each meeting day, students will take a team-Readiness Assurance Test (tRAT) consisting of 3 - 8 multiple-choice questions based on the on-line material of that week. Some of these questions may have appeared in the Canvas Quiz of that week. Team answers will be recorded on scratch-off cards that will be provided (if the team does not uncover a correct answer, they continue to discuss the question and sequentially select other choices, but receiving progressively lower scores: 1/2 for 2 scratchs, ¼ for 3 scratchs). All team members present will receive the same score. These quizzes cannot be made up or taken late if missed except for because of an excused absence. Individuals (for quiz questions) or teams (for t-RAT questions) can submit a written appeal to their instructor for questions they feel may have a valid alternate answer.

The Midterm Exam will be given on campus in the evening of Monday Oct. 3 (7:20-9:10 pm), closed book. Students must bring a laptop to take the exam which will consist of about 50 multiple choice questions (some taken from quizzes, some new). Everything associated with the class up to the point of the exam (Weeks 1-6), including on-line material and in-class discussion/exercises, is fair game on the mid-term exam. If there is an issue with attending the exam at this time, it should be discussed with the TA at least one week prior to the date.

In-Class Activities

At each class meeting, there will be a team assignment (answer to questions, spreadsheet calculation, etc.) to be completed and turned in, usually via Canvas (Assignment Tab) by the evening of the day of class (11:59 pm). Exceptions may be granted by special arrangement with the TA. These assignments will not be accepted after 1 week following the class. Full credit will be awarded as follows:

- 4 points – Assignment was submitted by the due date (2 points if submitted within 1 day of due date)
- 7 points – Demonstrates complete competence in the terminology, concepts, methodologies and theories used within the subject area.
- 7 points – Critical Thinking: Carefully, logically, and fully analyzes information from multiple perspectives and develops reasoned solutions to problems within the subject area.
- 7 points – Communication: Clearly and effectively communicates knowledge, ideas, and reasoning in forms appropriate to the subject area.

Attendance

Worth 5% of your grade, attendance will be managed by the Canvas system. Also, 30% of the score for a day will be deducted for lateness. Let your TA know about any excused absence/lateness and the Canvas score can be corrected. No corrections will be made more than 1 week after the absence/lateness event.

Semester Project

Students, in groups of 3-4, will be asked to work as a team to create and evaluate either a strategy to mitigate or adapt to climate change. The strategies will range widely, e.g., from a solar-powered bicycle to a change in international law. But we encourage student groups to consider a local or regional problem and solution. Each group will also quantitatively evaluate the cost and/or potential impacts that would result from the adoption of their strategy. During the course of the semester, both lectures and sub-assignments will build students' skills and the knowledge base needed for this kind of problem solving. At the end, both an oral and a written presentation will be due. More details can be found on the course website.

Extra Credit/Field Trip

We will visit the Solar Park just south of campus (Solar Decathlon House, Solar array, Bioenergy Lab) on the afternoon of Friday Oct. 7 (likely). Those attending the field trip will receive 2.5% extra credit added to final grade

tally. HOWEVER, if you commit to going but do not show up, I will deduct 0.5% from your final grade. Transportation will be provided.

The only other extra credit opportunity will be a survey about your views of science and climate change. If you complete BOTH an initial and final survey, you will receive a 1% addition to your final grade. You will receive announcements about this via e-mail (first and last week of the course).

COURSE AND UNIVERSITY POLICIES

Absence/Late Assignments
Students are expected to complete all requirements (quizzes, exams, presentation) on the specified dates and will not be granted an alternate date unless they have an acceptable reason for their absence (e.g., due to medical emergency, observance of religious holidays, military obligation, etc.) and pre-arranged consent of the instructor. These requests must be timely and accompanied by all necessary written documentation. This policy is accordance with UF's attendance policies, which can be reviewed further at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. Quizzes and assignments completed late will suffer a loss of points spelled out in each section above (generally half off). No assignment can be turned in more than 1 week after its due date without instructor consent. Discussions cannot be completed late.

Grade Appeals
Students or student groups who feel that their quiz, discussion, in-class activity or semester project was graded unfairly or incorrectly should make an appointment with their TA to discuss the issue. If students are still dissatisfied with the resulting explanation or action, they should then make an appointment with the lead instructor to discuss the issue.

Classroom policy
Students are required to bring to each class meeting a laptop or similar device for use in taking notes, summarizing in-class activities, and accessing the Internet. However, use of mobile devices and computers during class for purposes other than viewing readings or conducting sanctioned research/communications is not allowed. Students who receive or make calls or text messages or engage in other disruptive behavior during class will be asked to leave will not be allowed to turn in the assignment due on that day.

Academic Honesty Policy
Students must conform to UF's academic honesty policy regarding plagiarism and other forms of cheating. This means that on all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The university specifically prohibits cheating, plagiarism, misrepresentation, bribery, conspiracy, and fabrication. For more information about the definition of these terms and other aspects of the Honesty Guidelines, see http://www.dso.ufl.edu/sccr/process/student---conduct---honor---code/. All students found to have cheated, plagiarized, or otherwise violated the Honor Code in any assignment for this course will be prosecuted to the full extent of the university honor policy, including judicial action and the sanctions listed in paragraph XI of the Student Conduct Code. For serious violations, you will fail this course.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Such violations are also against University policies so disciplinary action may be taken.

Accommodations for Students with Disabilities
Please do not hesitate to ask for accommodation for a documented disability. Students requesting classroom accommodation must first register with the Dean of Students Office (http://www.dso.ufl.edu/drp/). The Dean of

Students Office will provide documentation to the student, who must then provide this documentation to the Instructor when requesting accommodation. Please ask the instructor if you would like any assistance in this process. Please provide this information to your TA within the first two weeks of the semester.

Instructor Evaluation
Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open.

Drop/Add/Withdrawal
A student can drop/add during the drop add period with no penalty. After drop/add, a student who drops will receive a W until the date listed in the academic calendar. After that date, the student may be assigned an "E" (fail). Note: it is the responsibility of the STUDENT to withdraw from a course, not the instructor. Failure to participate/complete the class is NOT a drop.

Additional Resources
Students facing difficulties completing the course or who are in need of counseling or urgent help may contact the Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; or the University Police Department: 392-1111 or 9-1-1 for emergencies.
Other Resources available on-campus for students include:

a. Student Mental Health, Student Health Care Center, 392-1171, personal counseling;
b. Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161, sexual counseling;
c. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

Fall 2016 COURSE SCHEDULE

Week Of:	Week #		Fundamental Science Topic	Framework Topic	Other Activities	Reading in 2nd Ed. *Dire Predictions* pgs.
21-Aug	1	Introduction to climate and CC	Disciplines of climate change	Interdisciplinary Science		
28-Aug	2		Climate Drivers	Scientific Method		6-29
4-Sep	3		Climate History	How Science is Done		30-51
11-Sep	4		Evidence for Anthro. CC	Uncertainty/Consensus		30-51
18-Sep	5		CC and the Weather	Research and Big Data	Intro. Semester Project (2nd hr)	52-67 & 112-115 & 132-135
25-Sep	6		CC Projections	Models	Sem. Proj. Initial Proposals	68-117
2-Oct	7	Problems and Solutions	Ecological Impacts of CC	Team Science	Midterm Exam – Oct. 3 (7:20 pm)	124-131 & 188-189
9-Oct	8		Population/Consumption	Ethics /Sustainability	Field trip – Oct 7	136-149 & 206-207
16-Oct	9		Agriculture/ Land Use	Communicating Science	Sem. Project Hypoth./Source	150-163 & 184-187
23-Oct	10		Energy	From Lab to the Real		164-177
30-Oct	11		Built Environment	Effecting Change	Sem Proj. Quant. Method Pres.	178-199
6-Nov	12	CC Policy	Environmental Policy	Science in Action		200-213
13-Nov	13		Sea Level Rise	Science in the Public Realm		36-37 & 110-111 & 122-123 & 158-159
20-Nov	x		- - - - - - - - - - - - - - - - - - No Class – Thanksgiving Week -			
27-Nov	14		- - - - - - - - - - - - - - - - - - Semester Project Presentations During Class - - - - - - - - - - - - - - - - - -			
4-Dec	15		- - - - - - - - - - - - - - - - - - Semester Project Paper & Individual Assessment Due Dec 9 - - - - - - - - - - - - - - - - - -			

COURSE READINGS

Selected Examples of assigned readings (in addition to almost all of the 212 page textbook):

Peer Reviewed Research

Fudge, D., 2014. Fifty years of J. R. Platt's strong inference. The Journal of Experimental Biology, 217: 1202-1204 doi:10.1242/jeb.104976.

Monnin et al., 2010. Atmospheric CO2 Concentrations over the Last Glacial Termination. Science. 291: 112-114. DOI: 10.1126/science.291.5501.112.

Hites, R.A. How To Give a Scientific Talk, Present a Poster, and Write a Research Paper or Proposal, Environ. Sci. Technol. 2014, 48, 9960−9964. dx.doi.org/10.1021/es503552t.

Teigen, K.H., 2014. When very likely is not so likely. NATURE CLIMATE CHANGE , v.4

Doran and Zimmerman, 2009. Examining the Scientific Consensus on Climate Change, Eos, VOLUME 90 NUMBER 3. DOI: 10.1029/2009EO030002.

Curry, JA and PJ Webster, 2013. Climate change: no consensus on consensus. CAB Reviews, v8.

Kitchn., R., Big Data, new epistemologies and paradigm shifts. Big Data & Society 2014 1. DOI: 10.1177/2053951714528481.

Retchless, D., Frey, N., Wang, C., Hung, L., Yarnal, B. 2014. Climate extremes in the United States: recent research by physical geographers. *Physical Geography*, 35:1, 3-21.

Davidson, E.A. et al., 2012. The Amazon basin in transition. Nature 481, 321-328. doi:10.1038/nature10717.

Costanza et al., 1997. The value of the world's ecosystem services and natural capital. *Nature* 387:253-260.

Twenty Landmark Papers in Biodiversity Conservation. Chapter 6: Twenty Landmark Papers in Biodiversity Conservation. By: Bradshaw, N. S. Sodhi, W. F. Laurance, B. W. Brook. In Research in Biodiversity - Models and Applications (2011).

Gardiner, S. M. & Hartzell-Nichols, L., 2012. Ethics and Global Climate Change. Nature Education Knowledge 3(10):5.

Kelly, T. (2001). Chapter 4 "The Perfect Brainstorm" in The art of innovation: Lessons in creativity from IDEO, America's leading design firm. New York: Doubleday.

Rockstrom et al., 2009. A safe operating space for humanity. Nature 461: 472-475

Mejean et al., 2015. Equity, burden sharing and development pathways: reframing international climate negotiations. Int Environ Agreements, 15:387–402

Bertaud, A. and Richardson, H.W. (2004), "Transit and density: Atlanta, the United States and Western Europe", in Bae, C. and Richardson, H.W. (Eds), Urban Sprawl in Western Europe and the United States, Ashgate, Aldershot, pp. 293-310.

The Popular Press

The Real Scientific Consensus on Climate Change http://www.foxbusiness.com/business-leaders/2014/06/05/real-scientific-consensus-on-climate-change/

The Seven Warning Signs of Bogus Science http://www.quackwatch.com/01QuackeryRelatedTopics/signs.html

NOVA science-Now video on Tropical Ice Cores Measure Climate, http://www.pbslearningmedia.org/asset/clim10_vid_icecores/

Climate change is an uncertain science by John Howard. *The Telegraph*. 09 Nov 2013.

Broome, J., 2008. The Ethics of Climate Change. *Scientific American* , **298**, 96-102.

Government Agencies

Climate Change 2007: Working Group I: The Physical Science Basis, Chapter 1: Historical Overview of CC, http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1.html

IPPCC Fifth Assessment Report (AR5) Home page. http://www.ipcc.ch/index.htm

Climate Change 2013, The Physical Science Basis, Summary for Policymakers, A report of Working Group I of the IPCC (selected portions; p 4-25, 36-41 and 114-115). http://www.ipcc.ch/report/ar5/wg1/

IPCC Special Report s, CHpater 5, Emissions Scenarios (SRES). http://www.ipcc.ch/ipccreports/sres/emission/index.php?idp=0

IPCC Special Report: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) Chapter 3: Changes in Climate Extremes and their Impacts on the Natural Physical Environment http://ipcc-wg2.gov/SREX/images/uploads/SREX-Chap3_FINAL.pdf

NASA Earth Observatory Website on Paleoclimatology
http://earthobservatory.nasa.gov/Features/Paleoclimatology_SedimentCores/

Specific sections: Executive Summary p. 111-114, Section 3.2 Requirements and Methods for Analyzing Changes in Extremes 3.2.1 Observed Changes p. 122 – 125 (skip box), Box 3-2 p. 132 ~ 6 pages of reading

NOAA/NCDC report on billion dollar weather and climate events from 1980-2003
http://www1.ncdc.noaa.gov/pub/data/techrpts/tr200301/tr2003-01.pdf

Southeast Climate Consortium's agroclimate website climate fact sheets: Fundamentals of Climate variability and Change
http://agroclimate.org/fact-sheets-climate.php

NOAA National Climatic Data Center: http://www.ncdc.noaa.gov/cag/time-series/us

Ecosystem Services Fact Sheet, Ecological Society of America
http://www.esa.org/ecoservices/comm/body.comm.fact.ecos.html

Academic Resources

On Science: http://undsci.berkeley.edu/article/0_0_0/us101contents_01

Zimmerman, A.R., 2014. How science is *really* done.

SENSE ABOUT SCIENCE, MAKING SENSE OF UNCERTAINTY, 2013.
http://www.senseaboutscience.org/resources.php/127/making-sense-of-uncertainty

Naomi Oreskes on the Merchants of Doubt, https://www.youtube.com/watch?v=wX3y6BQd4LI

Holgate, S.A., 2014. How to Collaborate. *Science*. 10.1126/science.caredit.a1200082

Non-Governmental Agencies

Climate Drivers http://co2now.org/Know-the-Changing-Climate/Climate-System/ipcc-explains-earths-climate-system.html

Selections from Climate Change Reconsidered II – Physical Science. Published for the Nongovernmental International Panel on Climate Change (NIPCC). Heartland Institute. 2013.

Can we live inside the doughnut? Why the world needs planetary and social boundaries: http://blogs.oxfam.org/en/blog/12-02-13-can-we-live-inside-doughnut-why-world-needs-planetary-and-social-boundaries

Southeast Climate Consortium's agroclimate website climate fact sheets. http://agroclimate.org/fact-sheets-climate.php

Brown and Taylor, 2015. Ethics and climate change : a study of national commitments. IUCN World Commission on Environmental Law (WCEL). Monographic Series no. 86.

Global Warming's Six Americas in September 2012. Report by Yale Project on Climate Change Communication and the George Mason University Center for Climate Change Communication.

GENERAL EDUCATION

This course fulfills a Physical Science (P) General Education requirement

General Education Objectives (Physical Sciences)
Physical science courses provide instruction in the basic concepts, theories and terms of the scientific method in the context of the physical sciences. Courses focus on major scientific developments and their impacts on society, science and the environment, and the relevant processes that govern physical systems. Students will formulate empirically-testable hypotheses derived from the study of physical processes, apply logical reasoning skills through scientific criticism and argument, and apply techniques of discovery and critical thinking to evaluate outcomes of experiments.

Accomplishment of General Education Objectives (Physical Sciences)
The general education objectives will be accomplished through the examination of the issue of climate change; climate science, climate change impacts, and approaches to finding solutions to the 'wicked problem' of climate change. Each week, students will study on-line material on a 'hard science' climate change (Fundamental) topic and a 'doing science' or 'science and society (Framework) topic'. Then, in class meetings each week, the two topics will be brought together and reinforced by doing critical thinking and application exercises and discussions.

General Education Student Learning Outcomes (Physical Sciences)
The general education student learning outcomes describe the knowledge, skills and attitudes that students are expected to acquire while completing a general education course at the University of Florida. The SLOs fall into three areas: content, communication and critical thinking.

- Content: Students identify, describe, and explain the basic concepts, theories and terminology of natural science and the scientific method within the subject area. Identify, describe, and explain the major scientific developments within the subject area and the impacts on society and the environment. Identify, describe, and explain relevant processes that govern biological and physical systems within the subject area.
- Critical Thinking: Students formulate empirically-testable hypotheses derived from the study of physical processes or living things within the subject area. Apply logical reasoning skills effectively through scientific criticism and argument within the subject area. Apply techniques of discovery and critical thinking effectively to solve experiments and to evaluate outcomes
- Communication: Students communicate scientific findings clearly and effectively using oral, written and/or graphic forms. Write effectively in several forms, such as research papers and laboratory reports.

General Education Student Learning Outcomes Assessment (Physical Sciences)

- Content: Mastery of discipline-specific science-related content (terminology, concepts, theories etc.) will be assessed through weekly on-line quizzes that will be taken by students after viewing weekly on-line materials as well as in the mid-term exam. (total 50% of final grade)
- Communication: In weekly class meetings, students will be required to participate in open-ended thoughtful discussions regarding the climate change topics and policy implications, the process of scientific discovery, ethics, and applications. Students will communicate their ideas to their peers while working in groups to communicate to generate creative solutions of a scientific nature and also present these final projects formally to the larger group. (total 20% of final grade)
- Critical Thinking: Each week, students will complete exercises, sometimes individually and sometimes in groups, which require them to synthesize and interpret scientific data, and lead them to support or reject existing scientific hypotheses. Hypothesis testing is most explicitly addressed in week 2 of the course in which students formulate their own scientific hypotheses regarding drivers of climate and experiments to test those

hypotheses, and in week 4, in which students will critically evaluate data proposed to support established hypotheses. (total 30% of final grade)

<u>This course fulfills an International (N) General Education requirement</u>

General Education Objectives (International)

International courses provide instruction in the values, attitudes and norms that constitute the contemporary cultures of countries outside the United States. These courses lead students to understand how geographic location and socioeconomic factors affect these cultures and the lives of citizens in other countries. Through analysis and evaluation of the students' own cultural norms and values in relation to those held by the citizens of other countries, they will develop a cross-cultural understanding of the rest of the contemporary world.

Accomplishment of General Education Objectives (International)

The general education objectives will be accomplished through the examination of the issue of climate change; climate science, climate change impacts, and approaches to finding solutions to the 'wicked problem' of climate change. Each week, students will study on-line material on a 'hard science' climate change (Fundamental) topic and a 'doing science' or 'science and society (Framework) topic'. Then, in class meetings each week, the two topics will be brought together and reinforced by doing critical thinking and application exercises and discussions.

General Education Student Learning Outcomes (International)

The general education student learning outcomes describe the knowledge, skills and attitudes that students are expected to acquire while completing a general education course at the University of Florida. The SLOs fall into three areas: content, communication and critical thinking.

- Content: Students identify, describe, and explain the values, attitudes and norms that shape the cultural differences of peoples who live in countries other than the United States. Identify, describe, and explain the roles of geographic location and socioeconomic factors on the lives of citizens in other countries.
- Critical Thinking: Students analyze and evaluate their own cultural norms and values in relation to those held by citizens in other countries.
- Communication: The international designation is always in conjunction with another category. Communication outcomes are listed in those subject areas.

General Education Student Learning Outcomes Assessment (International)

- Content: Mastery of discipline-specific science-related content (terminology, concepts, theories etc.) will be assessed through weekly on-line quizzes that will be taken by students after viewing weekly on-line materials as well as in the mid-term exam. (total 50% of final grade)
- Communication: In weekly class meetings, students will be required to participate in open-ended thoughtful discussions regarding the climate change topics and policy implications, the process of scientific discovery, ethics, and applications. Students will communicate their ideas to their peers while working in groups to communicate to generate creative solutions of a scientific nature and also present these final projects formally to the larger group. (total 20% of final grade)
- Critical Thinking: Each week, students will complete exercises, sometimes individually and sometimes in groups, which require them to synthesize and interpret scientific data, and lead them to support or reject existing scientific hypotheses. Hypothesis testing is most explicitly addressed in week 2 of the course in which students formulate their own scientific hypotheses regarding drivers of climate and experiments to test those hypotheses, and in week 4, in which students will critically evaluate data proposed to support established hypotheses. (total 30% of final grade)

GRADING RUBRICS

For each activity, students are provided with specific instructions for completing the activity and a grading rubric, all within Canvas. The grading rubrics are designed to evaluate the student's mastery of specific content and their ability to produce bodies of work within the guidelines specified in the instructions.

Rubric for Grading of Weekly In-class Activity

Criteria/Score	Outstanding:	Satisfactory:		Unsatisfactory:
SUBMISSION	In-class activity was submitted by the due date. (4 pts)	In-class activity was submitted within 1 day of the due date (2.0 pts)		ICA was submitted between 1 and 7 days after the due date (0 pts).
CONTENT	Demonstrates complete competence in the terminology, concepts, methodologies and theories used within the subject area (7 pts).	Demonstrates some competence in the terminology, concepts, methodologies and theories used within the discipline (5 pts).		Demonstrates poor competence in the terminology, concepts, methodologies and theories used within the discipline (<7 pts).
COMMUNICATION	Communicates knowledge, ideas, and reasoning clearly and effectively, very polished and practiced (10-9 pts).	Communicates knowledge, ideas, and reasoning, somewhat polished and practiced (8.9-7).		Does not communicates ideas, and reasoning effectively, not polished or practiced (<7 pts).
CRITICAL THINKING	Thorough consideration of issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops reasoned conclusions (10-9 pts).	Considers issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops reasoned conclusions (8.9-7 pts).		Does not considers issues from multiple perspectives or logically analyze evidence from credible, relevant sources, and develop reasoned conclusions (<7 pts).
Total: 25 pts				

Content	Demonstrates complete competence in the terminology, concepts, methodologies and theories used within the subject area. 7.0 pts	Demonstrates some competence in the terminology, concepts, methodologies and theories used within the subject area. 5.0 pts	Demonstrates poor competence in the terminology, concepts, methodologies and theories used within the subject area. 3.0 pts	No demonstration of competence in the terminology, concepts, methodologies and theories used within the subject area. 0.0 pts	7.0 pts
Critical Thinking	Carefully, logically, and fully analyzes information from multiple perspectives and develops reasoned solutions to problems within the subject area. 7.0 pts	To some extent, analyzes information from multiple perspectives and develops reasoned solutions to problems within the subject area. 5.0 pts	Mostly description or summary, without consideration or support of evidence. Generally unfocused and no connections made between ideas. 3.0 pts	Displays no evidence of engagement with the topic. 0.0 pts	7.0 pts

Communication	Clearly and effectively communicates knowledge, ideas, and reasoning in forms appropriate to the subject area. 7.0 pts	Somewhat clearly and effectively communicates knowledge, ideas, and reasoning in forms appropriate to the subject area. 5.0 pts	Fails to clearly and effectively communicate knowledge, ideas, and reasoning in forms appropriate to the subject area. 3.0 pts	The assignment is unfocused and/or displays little or no degree of completion. 0.0 pts	7.0 pts

Rubric for Grading of Quantitative Method Presentation (Semester Project)

ELEMENT COMPLETION (20 points total)

___/1 pt Title Slide (one slide): title and group members
___/1 pt Introduction (one slide) – present problem
___/2 pt Detailed proposal outline (one slide)
___/2 pt Well-worded hypothesis and subhypotheses as to the efficacy of the project (one slide)
___/2 pt A method for quantitatively assessing the effectiveness/impact of each hypothesis
___/2 pt Equations presented are clear and use an equation editor
___/2 pt All benefits factored into equations (e.g. if C emissions were reduced, this was monetized)
___/2 pt Citations were made on each slide where fact was used
___/2 pt Bibliography (one slide) including alphabetic listing of all references cited (and no more).
___/2 pt Includes figures on almost every slide to make visually appealing
___/1 pt Text not too small, slides not packed with text
___/1 pt Presentation of material shared equally by group members

Criteria/Score	Outstanding:	Satisfactory:	Unsatisfactory:
CONTENT **Score __ / 10 pts**	Demonstrates complete competence in the terminology, concepts, methodologies and theories used within the discipline (10-9 pts).	Demonstrates some competence in the terminology, concepts, methodologies and theories used within the discipline (8.9-7 pts).	Demonstrates poor competence in the terminology, concepts, methodologies and theories used within the discipline (<7 pts).
COMMUNICATION **Score __ / 10 pts**	Communicates knowledge, ideas, and reasoning clearly and effectively, very polished and practiced (10-9 pts).	Communicates knowledge, ideas, and reasoning, somewhat polished and practiced (8.9-7).	Does not communicates ideas, and reasoning effectively, not polished or practiced (<7 pts).
CRITICAL THINKING **Score __ / 10 pts**	Thorough consideration of issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops reasoned conclusions (10-9 pts).	Considers issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops reasoned conclusions (8.9-7 pts).	Does not considers issues from multiple perspectives or logically analyze evidence from credible, relevant sources, and develop reasoned conclusions (<7 pts).
Total: __ / 50			

Rubric for Grading of Final Project PRESENTATION (Semester Project)

ELEMENT COMPLETION (20 points total)
___/2 pt Title Slide, Introduction, Detailed proposal
___/2 pt Well-worded hypothesis and subhypotheses as to the efficacy of the project
___/2 pt Hypothesis testing method clearly explained. Equations presented are clear and use an equation editor , all numbers have units
___/2 pt All benefits factored into equations (e.g. if C emissions were reduced, this was monetized)
___/2 pt All data used to solve equations clearly explained and sources given
___/2 pt Quantitative error analysis conducted (not just qualitative list of uncertainties)
___/2 pt Conclusions drawn linked directly to quantitative analysis (hypothesis testing) done
___/2 pt Larger significance discussed (importance beyond the scope of the project proposed)
___/2 pt Citations made on each slide where fact was used. Bibliography alphabetic and lists all references cited.
___/2 pt Figures on almost every slide. Text not too small. Presentation shared equally by group members.

Criteria/Score	Outstanding:	Satisfactory:	Unsatisfactory:
CONTENT **__ /20 pts**	Complete competence in applying the terminology, concepts, methodologies and theories used within the subject area (20-18 pts).	Some competence in applying the terminology, concepts, methodologies and theories used within the subject area (17.9-14 pts).	Poor competence in applying the terminology, concepts, methodologies and theories used within the subject area (<14 pts).
COMMUNICATION **__ /20 pts**	Communicates knowledge, ideas, and reasoning clearly and effectively, very polished and practiced (20-18 pts).	Communicates knowledge, ideas, and reasoning, somewhat polished, with some polish & practice (17.9-14 pts).	Does not communicate ideas and reasoning effectively, not polished or practiced (<14 pts).
CRITICAL THINKING **__ /20 pts**	Thorough consideration of issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops fully reasoned conclusions (20-18 pts).	Considers issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops reasoned conclusions (17.9-14 pts).	Does not consider issues from multiple perspectives or logically analyze evidence from credible, relevant sources, and develop reasoned conclusions (<14 pts).
Total: ____ /80 Points			

Rubric for Grading of Final Project PAPER (Semester Project)

ELEMENT COMPLETION (20 points total)

___/2 pt Title Page supplied. Whole paper formatted as required.
___/2 pt Abstract provides a good summary of whole paper .
___/2 pt Background and detailed proposal well explained.
___/2 pt Hypotheses and testing method clearly explained. Equations presented are clear and use an equation editor. All data used to solve equations clearly explained and sources given.
___/2 pt All benefits factored into equations (e.g. if C emissions were reduced, this was monetized).
___/2 pt Quantitative error analysis conducted (not just qualitative list of uncertainties).
___/2 pt Conclusions drawn linked directly to quantitative analysis (hypothesis testing) done.
___/2 pt Larger significance discussed (importance beyond the scope of the project proposed).
___/2 pt Bibliography alphabetic and lists all references cited (and no more). Citations made correctly.
___/2 pt Improvements made in response to the critiques made after oral presentation.

Criteria/Score	Outstanding:	Satisfactory:	Unsatisfactory:
CONTENT **__ /20 pts**	Complete competence in applying the terminology, concepts, methodologies and theories used within the subject area (20-18 pts).	Some competence in applying the terminology, concepts, methodologies and theories used within the subject area (17.9-14 pts).	Poor competence in applying the terminology, concepts, methodologies and theories used within the subject area (<14 pts).
COMMUNICATION **__ /20 pts**	Communicates knowledge, ideas, and reasoning with very clear and organized prose (20-18 pts).	Communicates knowledge, ideas, and reasoning, with somewhat clear & organized prose (17.9-14 pts).	Does not communicate ideas and reasoning effectively. Prose not clear or organized (<14 pts).
CRITICAL THINKING **__ /20 pts**	Thorough consideration of issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops fully reasoned conclusions (20-18 pts).	Considers issues from multiple perspectives, logically analyzes evidence from credible, relevant sources, and develops reasoned conclusions (17.9-14 pts).	Does not consider issues from multiple perspectives or logically analyze evidence from credible, relevant sources, and develop reasoned conclusions (<14 pts).
Total: ____ /80 Points			