Course Abstract

If you need accommodations due to a disability, contact Disability Services in Edison Hall, Room ED100 or call at 732-906-2546.
To foster a productive learning environment, the College requires that all students adhere to the Code of Student Conduct which is published in the college catalog and website.

Course ID and Name: SCI 179: Climate Science

Department:
Chairperson or Course Coordinator: Dr. Donna Howell
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Prerequisites: Appropriate score on the College's Placement Test or MAT 013
Co-requisites: None

Course Description:
This lab-based course engages students in critical thinking about contemporary theories and issues in climate science. Students examine the major forces, feedbacks, cycles and oscillations that create climate at local and global scales in labs and lecture. Changes in climate over geological as well as historic time are introduced in lecture and expanded in lab through the study of bio-stratigraphy/indexing of fossils and proxy data analysis. Students use Climate Science as a tool to understand the practice of modern science and the assessment of evidence by the scientific community. Students also study the impact of climate change on biodiversity and sustainable resources, and formulate solutions to global issues and challenges.

General Education Status: GE MST

Credits: 3 **Lecture Hours: 2** **Lab Hours: 2**

Learning Outcomes:
Upon successful completion of this course, students will be able to:

1) Apply the general principles of the scientific method to analyze data and draw valid conclusions.
2) Explain the complexity and functioning of the Earth's climate systems as they impact the biological and chemical processes on our planet
3) Examine the contemporary climate issues.
4) Investigate the impact of human activities on climate.
5) Discuss the cultural, social, and economic issues affecting the potential solutions to address the climate change.

6) Evaluate the global impact of carbon emissions and other human activities on climate and ocean chemistry.
7) Evaluate the impact of climate change on the survival and evolution of species.

Course Content Areas:

Unit #1 Understanding Climate

- The Scientific Method
- Climate vs Weather
- The Characteristic of the Atmosphere
- High vs Low Pressure
- The World Ocean – Specific Heat, Salinity, Ocean Layered Structure, Currents, Ekman Spiral
- Global Oscillation - El Nina and La Nina / Antarctic Oscillation
- The Carbon Cycle
- The Greenhouse Effect
- The Scientific Method

Unit #2 Paleoclimates

- Plate Tectonics/ Continental Drift
- Geologic Time
- Isotopes
- Ice Cores
- Foraminifera
- Milankovitch Cycles
- Precipitation and Drought
- Severe Storms
- The Arctic Ice Cap
- Melting permafrost and Changing Tundra
- Lessons from Sea Level Rise

Unit #3 The Biological Implications of Climate Change

- Extinction
- Species
- Adaptation
- Can species adapt fast enough to survive to our changing climate
- The fate of species

Unit #4 Climate Models and Future Energy

- Sustainable energy sources
- Petroleum
- LNG
- Fracking
- Coal
- Nuclear Option
- Solutions

Laboratory Schedule

Week	Description
1	**Scientific Method:** Students will review topics (i.e. Europa, Plate Tectonics, Evolution, and Higgs Boson) and fit them into the framework of the scientific method. They will practice writing hypotheses and collect meteorological data throughout the semester to evaluate their hypotheses.
2	**Visual Data:** Students will examine different graph types and which types of graphs are most suitable for presenting scientific data. Student will practice reading, creating, and interpreting data displayed on graphs.
3	**Hydroponic Gardening**: Students will start a hydroponic garden during the second week of the semester and care for the plants throughout. The left-over plants will be planted in the campus community garden at the end of semester.
4	**Heat Capacity:** Students will conduct an experiment to compare the temperature of sediment and water heated by a heating lamp, and record the change over time.
5	**Ocean Currents:** Students design an experiment to determine the role of density currents. A Ward's model will be used to demonstrate the density currents and their role in driving the global ocean currents.
6	**The Carbon Cycle:** Students will design an experiment to compare the temperature and rate of heating of ambient air versus a carbon dioxide rich container
7	**Carbonate Buffering System:** Students will analyze sediments, rocks, coral, and mollusk shells to determine their reaction with weak acids and examine the role these materials play in carbonate buffering system in the oceans, and the release of carbon dioxide into the atmosphere.
8	**Geologic Time:** Students will compare absolute and relative techniques to determine the age of geologic samples and stratigraphy. HHMI Earthviewer software will be used on the air in understanding the extent of geologic time. Students will examine the impact of the changes in oxygen, carbon dioxide, and day length on climate through geologic time.
9	**Biostratigraphy and Index Fossils:** Index fossils will be identified students from the Paleozoic, Mesozoic, and Cenozoic eras. Students will use the fossils as proxy data in determining the climate and geologic conditions during the examined species existence. The fossils will also be used as markers for a biostratigraphy exercise.
10	**Proxy Data:** Proxy data such as ice cores, sediment cores, and tree rings will be used from online paleoclimate websites to reconstruct the paleo-environments and the findings will be used to determine the accuracy of current climate models.
11	**Sustainability Resources:** Students will conduct experiments with heating, cooling, conduction, convection, and insulation using passive as well as active (photovoltaic cells) solar methods using a solar collector.
12	**Sustainability Resources:** Students will conduct experiments with heating, cooling, conduction, convection, and insulation using wind turbine to extract wind energy.

13	**Computer Climate Modeling:** Using STELLA models, students will examine the aspects of Earth's climate system, and using the computer models demonstrate the variability of climate system through time.
14	**Computer Climate Modeling:** Students will use data from the Ocean Observatories Initiative (OOI) to evaluate current conditions in the oceans and their impact on our climate.