

PALOMAR COLLEGE
COURSE OUTLINE OF RECORD FOR
DEGREE CREDIT COURSE

X Transfer Course _____ A.A. Degree applicable course
(check all that apply)

COURSE NUMBER AND TITLE: ES105 – Earth System Science: Climate Change

UNIT VALUE: 3

MINIMUM NUMBER OF SEMESTER HOURS: 48

BASIC SKILLS REQUIREMENTS: Appropriate language and computational skills.

ENTRANCE REQUIREMENTS

PREREQUISITE: None

COREQUISITE: None

RECOMMENDED PREPARATION: None

SCOPE OF COURSE: Introduction to the science of global change that includes an overview of the international political debate and the mechanisms of the climate system. Topics also examine climate change on different time scales including the Ice Ages and the outlook for climate change.

SPECIFIC COURSE OBJECTIVES:

- Students will investigate and analyze the current international political debate over climate-related issues.
- Students will explain the mechanisms involved in the greenhouse effect, identifying the role of water vapor, carbon dioxide, and methane in the process.
- Students will discuss and evaluate the uncertainties related to climate prediction.
- Students will identify and explain the parts of the carbon cycle and its link with the climate system.
- Students will describe the relationship between weather and climate, including basic components of the climate system relevant to long-term climate change.
- Students will investigate and discuss the relationship between ocean circulation and climate including major phenomena such as El Niño, upwelling systems and deep water circulation.
- Students will investigate ice, sediment and fossil records leading to the discovery of the Ice Ages; students will describe and analyze the astronomical mechanisms that influence Ice Age climate change.
- Students will investigate and discuss climate changes recorded during the last Millennium including the Little Ice Age, and identify possible mechanisms including volcanoes and solar cycles.
- Students will analyze the processes, such as computer modeling, used to predict climate and discuss problems involved in making such predictions.

CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:

- I. Climate in the Spotlight
 - A. General Overview
 - B. Is the Climate Changing?
 - C. Potential Problems Ahead
 - D. Kyoto and Den Haag: what is (not) happening?
 - E. The Intergovernmental Panel on Climate Change
 - F. Pundits and Advocates
- II. The Greenhouse Effect
 - A. General Overview
 - B. Why Earth is a Nice Place to Live
 - C. The Radiation Balance
 - D. The Importance of Water Vapor
 - E. More on the Role of Carbon Dioxide
 - F. Methane
 - G. The Link to the Ozone Problem
 - H. Major Uncertainties
- III. Attempts to Guess the Future
 - A. General Overview
 - B. Human Emissions of Carbon Dioxide
 - C. Future Energy Use
 - D. The Future of Methane
 - E. The Future of Nitrous Oxide
 - F. The Ozone Problem, CFC's and Alternatives
 - G. How much Carbon is in the Ground?
- IV. The Carbon Cycle and Climate
 - A. General Overview: Biogeochemistry
 - B. Why is the Atmospheric Reservoir of Carbon So Small?
 - C. Carbon Dioxide Through Geologic Time
 - D. Carbon Dioxide Through the Ice ages
 - E. The Breathing of Gaia
 - F. The Physical Carbon Pump
 - G. The Biological Carbon Pump
 - H. The Marine Carbon Cycle
 - I. The Terrestrial Carbon Cycle
- V. The Climate System
 - A. Climate and Weather
 - B. The Climate Machine
 - C. Trade Winds and the Hadley Cell
 - D. The Highs and Lows of the Westerlies
 - E. The Vital Importance of Monsoon Rains
 - F. Why Are There Seasons?
 - G. Cloud Formation and Climate
 - H. Hurricanes and Global Warming
- VI. Ocean Circulation and Climate
 - A. Introduction and Overview
 - B. Strawberries in Norway
 - C. The Icelandic Whirlpool
 - D. Origin of the Gulf Stream

- E. El Niño and its Effects
- F. Upwelling and Climate
- G. The Deep Atlantic Conveyor
- H. The Grand North-South Asymmetry
- I. The Great Atlantic-Pacific Asymmetry
- VII. The Ice Ages
 - A. Introduction and Overview
 - B. The Mystery of the Mammoth Teeth
 - C. Discovery of the Great Ice Age
 - D. Discovery of the Ice Age Record of the Deep Sea
 - E. Discovery of the Ice Age Climate Cycles
 - F. Milankovitch Theory Supported
 - G. Ice Core Science and Fluctuating Temperature
 - H. The Marvelous Speed of Deglaciation
- VIII. The Last Millennium
 - A. Introduction and Overview
 - B. A Tale of Viking Exploration
 - C. The Riddle of the Little Ice Age
 - D. Volcano Weather
 - E. Sun Cycles and Climate Change
 - F. Stories Told by Trees and Corals
 - G. Warming Since 1850A.D.
 - H. The Statistics of Change
- IX. Outlook for Climate Change
 - A. Introduction and Overview
 - B. Advances in Computer Modeling
 - C. Physics vs. Fudge Factors
 - D. The Humpty-Dumpty Problem
 - E. Lurking Monsters
 - F. Strategies for Coping
 - G. Strategies for Technologic Fixes
 - H. Business as Usual
 - I. The Good News
 - J. The Role of Research

REQUIRED READING:

Berger, W. H. and Teranes, J. ABC's of Climate Change. 28 August, 2001
 <<http://www.blackboard.com/courses/EDUC-30838>>
 (Access to this site is restricted to registered students.)

SUGGESTED READING:

May include the following or other similar Internet sites:

- EPA Global Warming Web Site <<http://www.epa.gov/globalwarming>>
- NOAA Home Page <<http://www.noaa.gov>>
- NOAA's Center for Climate Prediction <<http://www.cpc.ncep.noaa.gov>>
- U.S. Global Change Research Information Office <<http://www.gcrio.org>>

May also include journal articles such as:

- Hoffman, Paul F. and Daniel P. Schrag. "Snowball Earth." *Scientific American*, Jan. 2000:68-75.
- Alley, Richard B., and Michael L. Bender. "Greenland Ice Cores: Frozen in Time." *Scientific American*, Feb. 1998:80-86.

REQUIRED WRITING:

Two essays, 1 to 2 pages in length.

OUTSIDE ASSIGNMENTS:

Students are expected to spend a minimum of three hours per unit per week in class and on outside assignments, prorated for short-term classes.

Assignments may include any or all of the following: completion of required reading, participation in the on-line discussion board, investigation of class-related topics, and written assignments.

INSTRUCTIONAL METHODOLOGY:

Check all that apply:

- lecture
 laboratory
 lecture-laboratory combination
 directed study

DISTANCE LEARNING:

This course may be offered as a distance learning course and meets Title 5 regulations 55370, 55372, 55374, 55376, 55378, and 55380.

Yes No

If yes, check all that apply:

- Television Course (Video one-way, e.g. ITV, video cassette, etc.)
 Online Course (Text one-way, e.g. newspaper, correspondence, electronic file, etc.)
 Two-Way Video Conferencing (Two-way interactive video and audio)
 One-Way Video Conferencing (One-way interactive video and two-way interactive audio)
 Computer Assisted Instruction (A specialized form of mediated instruction relying primarily on student access to information and prepared lessons or teaching materials through a computer terminal, but not under immediate supervision of a qualified instructor.)

GRADING POLICY AND STANDARDS (include methods of determining whether the stated objectives have been met by students):

Quizzes	60 - 80%
Final Exam	10 - 20%
Assignments	10 - 20%
Participation	10 - 20%

IS COURSE REPEATABLE FOR REASON(S) OTHER THAN DEFICIENT GRADE?

Yes ___ No X Number of times course may be taken for credit: _____

If yes, identify specific provision of Title 5 Division 2 section(s), 55761-55763 and 58161 which qualifies course as repeatable:

CONTACT PERSON:

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SIGNATURES ON FILE