GEOG A130: INTRODUCTION TO WEATHER & CLIMATE

Item	Value
Curriculum Committee Approval Date	03/06/2024
Top Code	220600 - Geography
Units	3 Total Units
Hours	54 Total Hours (Lecture Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)
Associate Arts Local General Education (GE)	• Area 5 Physical and Biological Sciences, Scientific Inquiry, Life Science (OB)
Associate Science Local General Education (GE)	• Area 5 Physical and Biological Sciences, Scientific Inquiry, Life (OSB)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B1 Physical Science (B1)

Course Description

Introduction to the earth’s atmosphere and processes. Topics include: atmospheric structure and composition, solar radiation, energy budget, temperature, seasonal changes, atmospheric moisture, clouds and fog, precipitation, circulation systems, air masses and fronts, weather forecasting, climate and climate change. Transfer Credit: CSU; UC: Credit Limitation: GEOG A130 and GEOL A131 combined: maximum credit, 1 course. C-ID: GEOG 130.**C-ID:** GEOG 130.

Course Level Student Learning Outcome(s)

1. Student will identify, analyze and interpret spatial information for weather and climate processes.
2. Student will understand the spatial distributions, processes and controls of weather and climate processes from the global to local scale.

Course Objectives

- 1. Identify the structure and characteristics of the earth?s atmosphere.
- 2. Discuss the earth?s energy balance.
- 3. Explain the factors that determine the earth?s global temperature and distribution.
- 4. Demonstrate how to measure temperature using a variety of methods.
- 5. Describe the forces that cause atmospheric motion and create pressure systems, wind systems, global and local circulation.
- 6. Describe atmospheric moisture, clouds and precipitation processes, and their distributions.
- 7. Explain weather systems such as, mid latitude cylones, fronts, hurricanes, tornadoes thunderstorms and El Nino.
- 8. Classify and interpret atmospheric data through weather maps, radar imagery and satellite data.
- 9. Identify the earth?s climate distribution and explain the processes that determine the distribution.
- 10. Describe the causes and implications of historical climate change and current global warming.

Lecture Content

Composition and Structure of the Atmosphere Origin of the atmosphere Atmospheric gases Vertical layers and temperature profile Scientific method and hypothesis testing Solar Radiation, Seasons and the Global Energy Budget Types of energy Energy Transfer mechanisms Radiation and the Solar Constant Causes of the Earth s seasons and changes in solar energy Global Temperature Controls Absorption, Reflection and Scattering Transmission and the Greenhouse Effects Land and water contrasts Global temperature controls and distribution Measurement of temperature Temperature mean and range Instrumentation and placement Frost-free days Wind chill Temperature inversions Urban heat islands Current temperature trends and future projections Analyze IPCC Projections Atmospheric Pressure, Wind and Circulation Systems Principles of pressure and air movement Formation of pressure cells and troughs Single cell vs. three cell model Global distribution of pressure cells and seasonal shifts Measurement of pressure Dynamics of wind Coriolis force Pressure gradient Global wind systems Upper atmosphere winds and jet streams Local wind systems Monsoons Santa Ana Winds / Chinook / Foehn Land / Sea Breeze Mountain / Valley Breeze Katabatic Role of winds in ocean circulation Atmospheric Moisture The hydrologic cycle Phase change of water evaporation and condensation Calculating and interpreting humidity Adiabatic processes and lapse rates Dew point and types of surface condensation Formation and types of fog Compare and analyze climate data for various regions Clouds and Precipitation Cloud development and classes Lifting mechanisms Stable vs. Unstable air masses Role of lapse rates and temperatures Types of clouds and weather interpretation Precipitation formation Types of precipitation Measuring precipitation Raingages Snow pack Air Masses, Fronts and Mid-latitude Cyclones Formation and classification of air masses Life cycle of a mid-latitude cyclone Frontal formation, movements and weather Rossby Waves Anti-cyclones Impacts of global warming on cyclones Atmospheric Disturbances Lightening, Thunder, Tornadoes, Hurricanes, El Nino Process for lightning formation Charge separation Types of lightning Thunder Thunderstorms Tornado formation, movement, distribution and hazards Tropical storms and hurricanes formation, movement, distribution and hazards El Nino formation, duration and predictions Recent disasters Weather Forecasting Symbols on a standard weather station model Forecasting methods Types of forecasts Interpretation of meteorological maps and data Technology remote sensing, satellite, radar Global Climates and Patterns Koppen climate classification system Tropical and temperate climate distributions, characteristics and causes Mid-latitude climate distributions, characteristics and causes High-latitu de climate distributions, characteristics and causes Historical Climate Change Factors involved in climate change Changes in solar output Changes in earth s orbit Changes in land mass distribution and surface Changes in atmospheric turbidity and radiation absorbing gases Ice ages and glacial periods Warming and interglacial periods Global Warming

Causes and contributing factors Data and evidence Projections and models Feedback mechanisms Current observations Regional impacts

Method(s) of Instruction

- Lecture (02)
- DE Online Lecture (02X)

Instructional Techniques

Lecture Use of various media to demonstrate course content Small-group discussions and activites Handouts illustrating concepts covered in class Instructor feedback on projects and assignments

Reading Assignments

Students will spend 2 hours per week reading the assigned textbook or academic literature regarding the following: Predicting temperature increases using IPCC models. Assessing impacts of global warming on hurricanes. Investigating global warming impacts on temperature. Identifying global warming impacts on underrepresented communities.

Writing Assignments

Students will spend 1 hour per week on one or more of the following: Essay and short answer exam questions Research paper analyzing one or more of the topics covered in class Written assignments related to topics covered in class Problem solving and map interpretation

Out-of-class Assignments

Students will spend 2 hours per week on out-of-class assignment. Analyze predictions of global warming impacts with current observations. Which hypothesis were correct and which were different? Why? Predict temperature increases using IPCC models. Identify climate processes that contribute to different temperature and precipitation patterns climate for different regions. Collect and analyze weather data for one week. Provide photos representing weather characteristics.

Demonstration of Critical Thinking

Exams including objective and subjective questions Written reports or projects Homework assignments Practical assignments in class

Required Writing, Problem Solving, Skills Demonstration

Students will be required to complete one or more of the following: Essay and short answer exam questions Research paper analyzing one or more of the topics covered in class Written assignments related to topics covered in class Problem solving and map interpretation

Eligible Disciplines

Geography: Master's degree in geography OR bachelor's degree in geography AND master's degree in geology, history, meteorology, or oceanography OR the equivalent OR see interdisciplinary studies. Master's degree required.

Textbooks Resources

1. Required Aguado, E. Burt, J.. Understanding Weather and CLimate, 7th ed. Upper Saddle River, NJ: Pearson Perntice Hall, 2015 Rationale: This text is written by geographer Edward Aguado and is a classic foundation for topics in weather and climate. This text can be supplemented by readings and other materials that update the rapidly changing information related to climate change. 2. Required Moran, JM. Weather Studies: Introduction to Atmospheric Science, ed. American: American Meteorological Society, 2009 3. Required edited by Paul Sillitoe . The Anthroposcene of Weather and Climate: Ethnographic Contributions to the Climate Change Debate, 1st ed. New York: Berghahn Books , 2021 4. Required John J. Qu and Raymond P. Motha. Climate Change and a Sustainable Earth, 1st ed. Cambridge: Cambridge Scholars Publishing , 2022 5. Required John M. Wallace, David S. Battisti, David W. J. Thompson, Dennis L. Hartmann. The Atmospheric General Circulation, 1st ed. Cambridge: Cambridge University Press, 2023

Other Resources

1. Lab Maual- Carbone, Exercises in Weather and Climate. Upper Saddle River, NJ: Pearson Prentice Hall, 2009 2. IPCC Report 3. Journal Articles and new reports 4. Access to weather data http://weathersource.com 5. sample weather maps