



COURSE OUTLINE

DIVISION: Natural Sciences & Business

COURSE: GEG 1001 Weather and Climate

Date: Spring 2019

Credit Hours: 4

Prerequisite(s): None

Delivery Method: **Lecture** **3 Contact Hours (1 contact = 1 credit hour)**
 Seminar **0 Contact Hours (1 contact = 1 credit hour)**
 Lab **2 Contact Hours (2-3 contact = 1 credit hour)**
 Clinical **0 Contact Hours (3 contact = 1 credit hour)**
 Online
 Blended

Offered: **Fall** **Spring** **Summer**

IAI Equivalent – **P1905L Physical Science w/lab**

CATALOG DESCRIPTION:

An investigation into the science of the earth's atmosphere and its related weather. Emphasis will be placed on the origin and composition of the atmosphere, earth-sun relationships, radiation, temperature, humidity, condensation and precipitation, air pressure and winds, air masses, climates, severe weather, and forecasting. Typical assignments will involve interpretation of weather symbols, the identification of weather conditions and simple weather forecasting techniques.

GENERAL EDUCATION GOALS ADDRESSED

[See last page for Course Competency/Assessment Methods Matrix.]

Upon completion of the course, the student will be able:

[Choose up to three goals that will be formally assessed in this course.]

- To apply analytical and problem solving skills to personal, social, and professional issues and situations.
- To communicate successfully, both orally and in writing, to a variety of audiences.
- To construct a critical awareness of and appreciate diversity.
- To understand and use technology effectively and to understand its impact on the individual and society.
- To develop interpersonal capacity.
- To recognize what it means to act ethically and responsibly as an individual and as a member of society.
- To recognize what it means to develop and maintain a healthy lifestyle in terms of mind, body, and spirit.
- To connect learning to life.

EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

[Outcomes related to course specific goals. See last page for more information.]

Upon completion of the course, the student will be able to:

1. Define weather in terms of its most basic elements.
 - Competency 1.1: Differentiate weather and climate.
 - Competency 1.2: Define the atmosphere and describe its interactions with other earth subsystems.
 - Competency 1.3: Describe the basic structure of the earth's atmosphere.
 - Competency 1.4: Identify the constituent gases composing the atmosphere.
2. Explain how inputs of solar energy affect the circulation of the earth's atmosphere and hydrosphere.
 - Competency 2.1: Differentiate shortwave (ultraviolet) radiation and longwave (infrared) radiation.
 - Competency 2.2: Provide examples of sensible heat and latent heat transfers.
 - Competency 2.3: Discuss role of latitude in determining total insolation.
 - Competency 2.4: Describe daily and seasonal surface temperature cycles.
 - Competency 2.5: Explain how the greenhouse effect contributes to global warming.
3. Describe the hydrologic cycle in terms of its basic elements and the physical processes that transform the state of water.
 - Competency 3.1: Explain the concept of latent heat.
 - Competency 3.2: Define humidity in absolute and relative terms.
 - Competency 3.3: Discuss the importance of dew point temperature.
 - Competency 3.4: Compute adiabatic lapse rates.
 - Competency 3.5: Identify lifting mechanisms operating within the atmosphere.
 - Competency 3.6.: Describe conditions contributing to atmospheric instability.
4. Identify clouds by type and explain how precipitation forms.
 - Competency 4.1: Differentiate low, middle, and high clouds.
 - Competency 4.2: Indicate why and how fog, dew, and frost form.
 - Competency 4.3: Identify various forms of precipitation.

- Competency 4.4: Explain how collision-coalescence operates in warm clouds.
- Competency 4.5: Explain how the Bergeron process operates in cold clouds.
- 5. Explain how major weather systems develop and move within the general circulation of the earth's atmosphere.
 - Competency 5.1: Discuss the significance of atmospheric pressure and the pressure gradient force.
 - Competency 5.2: Locate the intertropical convergence zone (ITCZ), areas of subtropical high pressure and the polar front.
 - Competency 5.3: Identify the five types of air masses and their respective source regions.
 - Competency 5.4: Explain the process of cyclogenesis.
 - Competency 5.5: Plot the seasonal tracks of the polar jet stream.
- 6. Define, identify, and track severe weather.
 - Competency 6.1: Identify thunderstorm types
 - Competency 6.2: Explain the relationship between thunder and lightning.
 - Competency 6.3: Define the boundaries of "Tornado Alley"
 - Competency 6.4: Classify tornadoes using the Enhanced Fujita scale.
 - Competency 6.5: Describe formation of tropical cyclones.
 - Competency 6.6: Discuss the importance of satellites and radar technology in severe weather detection and forecasting.
- 7. Define climate in terms of its past, present and future manifestations
 - Competency 7.1: Identify the principle controls of climate.
 - Competency 7.2: Utilize the Koppen climate classification system.
 - Competency 7.3: Use climographs to identify climate types.
 - Competency 7.4: Describe past climates using proxy data.
 - Competency 7.5: Explain the significance of "global warming."
 - Competency 7.6: Judge impact of anthropogenic influences (i.e., pollution).

MAPPING LEARNING OUTCOMES TO GENERAL EDUCATION GOALS

[For each of the goals selected above, indicate which outcomes align with the goal.]

Goals	Outcomes
First Goal	
To apply analytical and problem solving skills to personal, social, and professional issues and situations.	1. Define weather in terms of its most basic elements. 2. Explain how inputs of solar energy affect the circulation of the earth's atmosphere and hydrosphere. 3. Describe the hydrologic cycle in terms of its basic elements and the physical processes that transform the state of water. 4. Identify clouds by type and explain how precipitation forms. 5. Explain how major weather systems develop and move within the general circulation of the earth's atmosphere. 6. Define, identify, and track severe weather. 7. Define climate in terms of its past, present and future manifestations.

COURSE TOPICS AND CONTENT REQUIREMENTS:

1. Introduction to the Atmosphere

- A. Meteorology, Weather and Climate
 - B. Observing the Atmosphere
 - C. The Atmosphere as Part of the Earth System
 - D. Composition of the Atmosphere
 - E. Thermal Structure of the Atmosphere
2. Heating Earth's Surface and Atmosphere
- A. Earth-Sun Relationships
 - B. Energy, Heat and Temperature
 - C. Mechanisms of Heat Transfer
 - D. Incoming Solar Radiation
 - E. Terrestrial Radiation
 - F. Heat Budget
3. Temperature
- A. Controls of Temperature
 - B. Cycles of Air Temperature
 - C. Temperature Measurement
 - D. Applications of Temperature Data
4. Moisture and Atmospheric Stability
- A. Hydrologic Cycle
 - B. Changes of State
 - C. Humidity
 - D. Vapor Pressure and Saturation
 - E. Relative Humidity
 - F. Dew-Point Temperature
 - G. Adiabatic Temperature Changes
 - H. Lifting Mechanisms
 - I. Atmospheric Stability
5. Forms of Condensation and Precipitation
- A. Cloud formation
 - B. Cloud classification
 - C. Types of Fog
 - D. How Precipitation Forms
 - E. Forms of Precipitation
6. Air Pressure and Winds
- A. Horizontal Variations in Air Pressure
 - B. Factors Affecting Wind
 - C. Geostrophic flow and gradient wind
 - D. Surface winds
7. Circulation of the Atmosphere
- A. Scales of Atmospheric Motion
 - B. Local Winds
 - C. Global Circulation
 - D. Monsoons
 - E. Global Winds and Ocean Currents
 - F. El Nino, La Nina and Southern Oscillation
8. Air Masses
- A. Air Mass Types
 - B. Source Regions

- C. Properties of North American Air Masses
- 9. Weather Patterns
 - A. Polar Front Theory
 - B. Fronts
 - C. Mid-latitude Cyclones
 - D. Conveyor Belt Model
- 10. Thunderstorms and Tornadoes
 - A. Air-Mass Thunderstorms
 - B. Severe Thunderstorms
 - C. Squall Lines and Mesoscale Convective Complexes
 - D. Thunder and Lightning
 - E. Tornadoes
- 11. Hurricanes
 - A. Hurricane Formation
 - B. Hurricane Destruction
 - C. Hurricane Detection and Tracking
- 12. Weather Analysis and Forecasting
 - A. Weather Analysis
 - B. Weather Forecasting
 - C. Upper-Level Maps
 - D. Forecast Accuracy
 - E. Weather Satellites
- 13. Air Pollution
 - A. Sources and Types of Pollution
 - B. Meteorological Factors Affecting Air Pollution
 - C. Acid Precipitation
- 14. The Changing Climate
 - A. Climate System
 - B. Climate Change Detection
 - C. Natural Causes of Climate Change
 - D. Human Impact on Climate
 - E. Consequences of Global Warming
- 15. World Climates
 - A. Climate Classification
 - B. Climate Controls
 - C. Tropical Climates
 - D. Dry Climates
 - E. Humid Middle-Latitude Climates
 - F. Humid Continental Climates
 - G. Polar Climates

INSTRUCTIONAL METHODS:

1. PowerPoint slides
2. Lab exercises
3. Web-based learning modules
4. Online videos
5. Supplemental readings
 - (a) articles from professional journals and periodicals
 - (b) newspaper columns/features
 - (c) books

INSTRUCTIONAL MATERIALS:

Text: Understanding Weather and Climate, Edward Aguado & James E. Burt,
(7th Edition)

Lab Exercises: Exercises for Weather & Climate by Greg Carbone (9th Edition)

Supplements: maps, PowerPoint slides, professional journals, related website

STUDENT REQUIREMENTS AND METHODS OF EVALUATION:

1. Textbook reading
2. 12 lab exercises and corresponding lab quizzes
3. Four exams covering assigned readings
4. Climate change research project / including 1000-word written summary
5. Optional essays describing real-world applications

Grading scale:

90 - 100% A

80 - 89% B

70 - 79% C

60 - 69% D

<60% F

OTHER REFERENCES

1. Texts: The Concise Oxford Dictionary of Earth Sciences
2. Journals: Annals of the American Association of Geographers
 Bulletin of the American Meteorological Society
 Earth Interactions
 International Journal of Climatology
 Journal of Biogeography
 Journal of Geophysical Research
 National Geographic
 Science
 Scientific American
 Weather, Climate and Society

3. Websites: www.noaa.gov
National Oceanic and Atmospheric Association
www.nws.noaa.gov
National Weather Service
www.weather.com
Weather.com weather service
[ww2010.atmos.uiuc.edu/\(Gh\)/guides/mtr/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/home.rxml)
University of Illinois Meteorology department
radar.weather.gov
NWS Doppler radar sites
www.earth.columbia.edu
The Earth Institute at Columbia University
www.nationalgeographic.com
National Geographic Society
dsc.discovery.com
Discovery Channel
www.sciencenews.org
Magazine of the Society for Science & The Public
www.wmo.ch
World Meteorological Organization
www.ametsoc.org
American Meteorological Society
amglossary.allenpress.com/glossary
Glossary of meteorology
www.blueplanetbiomes.org
Biomes and Climate
www.cloudman.com
Cloud picture gallery

Course Competency/Assessment Methods Matrix

(Dept/# Course Name)	Assessment Options																																
For each competency/outcome place an "X" below the method of assessment to be used.	Assessment of Student Learning	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment	
		Direct/ Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D						
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.		X	X		X			X	X				X			X																X	
Define weather in terms of its most basic elements.	X	X		X				X	X				X			X																	
Explain how inputs of solar energy affect the circulation of the earth's atmosphere and hydrosphere.	X	X		X				X	X				X			X																	
Describe the hydrologic cycle in terms of its basic elements and the physical processes that transform the state of water.	X	X		X				X	X				X			X																	X
Identify clouds by type and explain how precipitation forms.	X	X		X				X	X				X			X																	X

Explain how major weather systems develop and move within the general circulation of the earth's atmosphere.		X	X	X				X	X				X	X															X	
Define, identify, and track severe weather.		X	X	X				X	X																			X		
Define climate in terms of its past, present and future manifestations.		X	X	X				X	X																			X		