



ILLINOIS VALLEY COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Natural Sciences and Business

COURSE: GEG 1001 Weather and Climate

Date: Spring 2023

Credit Hours: 4

Complete all that apply or mark "None" where appropriate:

Prerequisite(s): None

Enrollment by assessment or other measure? Yes No

If yes, please describe:

Corequisite(s): None

Pre- or Corequisite(s): None

Consent of Instructor: Yes No

Delivery Method:	<input checked="" type="checkbox"/> Lecture	3 Contact Hours (1 contact = 1 credit hour)
	<input type="checkbox"/> Seminar	0 Contact Hours (1 contact = 1 credit hour)
	<input checked="" type="checkbox"/> Lab	2 Contact Hours (2-3 contact = 1 credit hour)
	<input type="checkbox"/> Clinical	0 Contact Hours (3 contact = 1 credit hour)

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

CATALOG DESCRIPTION and IAI NUMBER (if applicable):

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. **IAI Equivalent: P1909L**

ACCREDITATION STATEMENTS AND COURSE NOTES:

None

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

INSTRUCTIONAL METHODS:

1. lecture, with supplementary PowerPoint slides
2. lab exercises
3. web-based learning modules
4. videos
5. supplemental readings
 - (a) articles from professional journals and periodicals
 - (b) newspaper columns/features
 - (c) books

EVALUATION OF STUDENT ACHIEVEMENT:

1. 14 lab exercises and corresponding lab quizzes
2. Three exams covering assigned readings in textbook
3. Two quizzes covering assigned readings in Dire Predictions text
4. Weekly current-events reports documenting weather or climate events

Grading scale:

90 - 100%	A
80 - 89%	B
70 - 79%	C
60 - 69%	D

INSTRUCTIONAL MATERIALS:

Textbooks

The Atmosphere: An Introduction to Meteorology, by Lutgens, Tarbuck, and Herman (14th Edition)

Dire Predictions: Understanding Climate Change, by Michael E. Mann and Lee R. Kump (2nd Edition)

Resources

lab exercises, maps, slides, professional journal articles

LEARNING OUTCOMES AND GOALS:

Institutional Learning Outcomes

- 1) Communication – to communicate effectively;
- 2) Inquiry – to apply critical, logical, creative, aesthetic, or quantitative analytical reasoning to formulate a judgement or conclusion;
- 3) Social Consciousness – to understand what it means to be a socially conscious person, locally and globally;
- 4) Responsibility – to recognize how personal choices affect self and society.

Course Outcomes and Competencies

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).