Bergen Community College
Division of Mathematics, Science and Technology
Department of Physical Sciences

Course Syllabus
PHY 112 - Climatology

1.
Semester and year:
Course Number:
Meeting Times and Locations:

Instructor:
Office Location:
Phone:
Office Hours:
Email Address:

2. COURSE TITLE: PHY112 CLIMATOLOGY

3. PREREQUISITES: None

4. COURSE DESCRIPTION: CLIMATOLOGY is a study of the Earth's climate. Climate elements and atmospheric heat transfer processes will be studied and applied to climate classification schemes. The effects of climate on human activities will be considered. Special attention will be given to the greenhouse effect, El Nino, Ice Age theories, climatic explanation for the extinction of the dinosaurs, and past and future climates. Laboratory work features simple analytical and statistical analysis of climate data. THIS IS A GENERAL EDUCATION COURSE.

5. TEXTBOOKS:

Opstbaum, Roger 1994: Climatology Notes, 1st ed. Kendall/Hunt, Dubuque, IA

6. LABORATORY MANUAL: Part of Climatology Notes.

7. STUDENT LEARNING OBJECTIVES
The student will be able to:
1. Demonstrate the fundamentals of the science of climatology, and of the many ways in which the climate affects our everyday lives.
2. Develop a vocabulary of climatological terms.
3. Know the distance and time scales for those subsystems composing theEarth's Climate System.
4. Know the differences between Climatology and Meteorology.
5. Know about how the Earth's present atmosphere evolved over time..
6. Know about electromagnetic radiation and how it interacts with matter on an atomic scale.
7. Know how our atmosphere is heated by the Sun.
8. Know Stefan-Boltzmann's Law.
9. Know Wien's Displacement Law.
10. Know the heat budget for the climate system.
11. Know the causes of the seasons.
12. Know how climate is modified by land/ocean distributions.
13. Know how climatological temperature records are kept.
14. Know which forces lead to the different types of dynamical wind systems.
15. Know the general circulation of the atmosphere.
16. Know about the causes of the major jetstreams.
17. Know what the monsoons are and what causes them.

18. Know how ocean currents affect climate.
19. Know how the variability of Water substance in its 3 phases affects climate.
20. Identify the different clouds and how cloudiness varies from pole to pole.
21. Identify the different fogs and how fog is distributed on the Earth.
22. Know the different types of precipitation.
23. Know the properties of air masses, fronts, and extratropical cyclones
24. Know how tropical storms arise.
25. Know how thunderstorms arise.
26. Know how tornadoes and waterspouts arise.
27. Know why climate classification schemes exist.
28. Designate any climate station under Koppen's classification scheme
29. Recognize the different climates of the world.
30. See how Water Resources affect climate.
31. Know the hydrologic cycle.
32. Know how the Runaway Greenhouse Effect works and the possibility of it happening on Earth in the future.
33. Recognize how mankind is enhancing Earth's Greenhouse Effect and its implications for changes in our lifestyles in the near future.
34. Know what causes the Urban Heat Island Effect.
35. Know what attempts have been made for mankind to consciously modify the atmosphere.
36. Know about climates of the past.
37. Recognize the causes of past Ice Ages and the knowledge to access the likelihood of an Ice Age in the future.
38. Know about climate modeling.

8. ASSESSMENT.

All of the objectives above will be assessed by students' performances on examinations. Objectives 11, 13, 28, 32, 33, and 34 will additionally be assessed through students' performances on laboratory reports.

9. SPECIAL NOTES.

A. Homework

If possible, text pages appropriate to a particular class meeting (see # 13, Syllabus, below) should be read before that class.

B. The Way The Course Will Be Run

The Climatology Notes contain notes which follow the instructor's lectures on lecture topics (see syllabus, below). While notes will not accompany discussion topics (shown in the syllabus in parenthesis), space is left for the student to take notes as she or he sees fit. The best way to use the lecture notes is to study them as the instructor is lecturing. Hopefully, the advantage is that this system allows you to focus your concentration on the material and understand it during the lecture, where you can ask questions of the instructor, and where you only have to jot down points you feel are missing from the notes. The regular note-taking system, in contrast, often forces a student to mainly concentrate on making sure she or he gets all the notes during a lecture. This usually causes the student to attempt an initial understanding of the material at home, where no one may be able to answer the student's questions. Using the lecture notes, the student will also have an excellent record of facts and definitions. The way not to use these notes is to use them as a replacement rather than a supplement, to never attend class, and never read the text. Experience has shown that the climate is most disagreeable for people who follow this latter procedure.

For discussion topics, your own note-taking is urged and you are encouraged to form your own opinion or conclusion regarding the topics, based on your analysis of the facts and your judgment. In cases where the text has no information on the subject, materials will be provided through the library or directly from the instructor

C. Lab Rules.

Lab reports are due the week following the lab. There are fairly stiff penalties for lateness: -5 the first week; -10 for each day after that since corrected labs will usually be handed back 1 week after they are due. Lab reports are expected to be neat and organized – a grader is in a much better mood (is more lenient) when he has an easy time going through the work. When possible, try to work alone. Cross checking and discussion of labs outside the classroom is not discouraged, but not when it gets to the point of plagiarism. Since plagiarism is anti-scientific, the consequences of getting caught at it are most severe.

10. TESTS

A. There will be 3 (three) modular exams plus a final. The exams will contain the following question types:

I. True-False
II. Multiple Choice
III. Fill-Ins
IV. Diagram
V. Definitions
VI. Essays
VII. Köppen Problem

How these will be proportioned on a given test will be discussed on a test-by-test basis as we proceed in the course.

B. Tests, except, of course, the final which is comprehensive, will not cover material discussed before the previous test. For a given test, definitions will come from words within the text of the notes, which are underlined. Essay questions will come from the discussion topics, which deal with controversial issues in Climatology.

C. Makeups, for valid reasons, are possible. However, mine tend to be much more difficult than the original exam (to compensate somewhat for the valuable extra time possible to study) and are thus discouraged. A dropped exam (see # 10 below) is an alternative.

D. Cheating is like plagiarism – anti-scientific – and will be dealt with the same way.

11. EVALUATION

Your composite grade will be determined according to one of the following two formulas:

Plan A: lowest grade does not occur on final exam.

20% Lab Grade.
20% Highest regular test grade.
20% Second highest regular test grade.
0% Lowest regular test grade (drop).
30% Final exam grade.
10% Instructor's evaluation.

Plan B: Lowest grade occurs on final exam.

20% Lab grade.
20% Each of 3 regular test grades.
10% Final exam grade.
10% Instructor's evaluation.

However, please note: Unless the student meets the following minimum requirements, he or she will receive an F grade:

1. The student must pass (achieve 60 or above) on at least one of the 4 tests regardless of the (possibly high) quality of the lab grades.

2. The student must complete and hand in at least 70% of the lab assignments regardless of the (possibly high) quality of the test grades.

12. FACULTY ABSENCE PROCEDURE: Please note well.

A daily listing of cancelled classes will appear in the glass case located next to the student center. . Students can consult this case before going to class. If students find a class cancelled which has not been listed, they should report this to the Evening and Saturday Office, Room L-113, or the Divisional Dean's Office, A325.

13. STUDENT ABSENCES:

The student is expected to obtain notes and other assignments missed during office hours or by appointment. i.e., class time cannot be taken up to attend to affairs resulting from an individual student's absence.

14. SYLLABUS

Class #	Lecture # (Discussion Topic #)	Topic
1	1	I. The Physical Elements Of Weather And Climate A. Climate And The Atmosphere. 1. Introductory Definitions. 2. The Scope Of Climatology. 3. Nature of The Atmosphere.
	(1)	4. Origin Of The Atmosphere. 5. Planetary Atmospheres. 6. Vertical Thermal Structure Of The Atmosphere.
2	2	B. Energy And Temperature. 1. Insolation. 2. The Theory Of Radiation. 3. The Solar Source. 4. The Radiation And Heat Budgets 5. Variability Of Insolation. 6. Measurement Of Sunshine And Insolation. 7. Air Temperature And Its Measurement 8. Temperature Records.

Class #	Lecture # (Discussion Topic #)	Topic
		9. Horizontal Temperature Distribution 10. Vertical Distribution Of Temperature.
3	3	C. Motion In The Climate System. 1. Introduction. 2. Atmospheric Pressure Measurements. 3. Pressure-Height Relations. 4. Horizontal Pressure Distribution. 5. Pressure And Circulation.

6. Factors Affecting Wind Direction And Speed.
7. Winds Aloft.
8. Diurnal Variation Of Wind Speed.
9. Wind Observations.
10. Mapping Wind Data.
11. Local Winds.
12. General Atmospheric Circulation
13. Upper Level Waves And Jet Streams.
14. Seasonal Changes In The General Circulation.
15. The Monsoons
16. Oceanic Circulation.

4	4	D. Atmospheric Moisture. 1. Introduction. 2. Water Vapor. 3. Humidity Measurements. 4. Physical Changes Of State Of Water. 5. Processes Of Cooling To Produce Condensation And Sublimation. 6. Clouds: Their Formation And Classification. 7. Cloud Observations. 8. Fog. 9. Precipation: Causes, Forms, Processses And Types. 10. Observations Of Precipitation. 11. Seasonal Variation Of Precipitation.

Class #	Lecture # (Discussion Topic #)	Topic
5	5	E. Weather disturbances. 1. Introduction. 2. Properties Of Air Masses. 3. Air Mass Identification And Analysis. 4. Air Mass Source Regions And Classification. 5. Stability And Instability. 6. The Extratropical Cyclone. 7. Fronts. 8. Mountain Barriers And Surface Fronts 9. Anticyclones. 10. Tropical Weather.
	(2)	11. Hurricanes. 12. Thunderstorms.
	(3)	13. Tornados And Waterspouts. 14. Other Air Mass And Storm Effects. 15. Observations Of Circulation Systems And Storms. 16. Regional Weather Patterns.

TEST 1

6	6	II. Patterns Of World Climate. A. Climatic Classification. 1. Introduction. 2. Approaches To Climatic Classification 3. Köppen's Classification. 4. Climatic Regions Of The World. 5. Climatic Time Scales.
7	7	B. Climates Dominated By Equatorial And Tropical Air Masses. 1. Introduction. 2. The Rainy Tropics. 3. Monsoon Tropics. 4. Wet – And – Dry Tropics 5. Tropical And Semi-Arid Climates
	(4)	6. El Nino.
		C. Climates Dominated By Tropical And Polar Air Masses 1. Introduction. 2. Dry Summer Subtropics. 3. Humid Subtropics. 4. Marine Climate.

Class #	Lecture # (Discussion Topic #)	Topic
8	8	5. Mid-Latitude And Semiarid Climates 6. Humid Continental Warm Summer Climate. 7. Humid Continental Cool Summer Climate. D. Climates Dominated By Polar And Arctic Air Masses; Highlan And Ocean Climates. 1. Introduction. 2. Taiga Climate. 3. Tundra Climate. 4. Polar Climate. 5. Highland Climates. 6. Ocean Climates.
9	9	III. Applied Climatology. A. Climate And Water Resources. 1. Introduction. 2. The Global Hydrologic System. 3. The Water Budget At The Earth's Surface. 4. Evapotranspiration. 5. Soil Moisture And Ground Water.

		6. Runoff And Floods.
		7. Climatic Causes Of Floods.
		8. Runoff Forecasting.
		9. Snow Surveying.
		10. Water Resources Management.
	(5)	11. The Greenhouse Effect.
	(6)	12. The Runaway Greenhouse Effect.
		TEST 2
10	10	B. Climate And The Biosphere.
		1. Introduction.
		2. Climatic Factors In Plant Growth.
		3. World Patterns Of Vegetation.
		4. Vertical Differentiation of Vegetation.
		5. Climate And Forestry.
		6. Forest-Fire Weather.
		7. Climate As A Factor In Soil Formation
		8. Spatial Patterns Of Soils.

Class #	Lecture # (Discussion Topic #)	Topic
		9. Climate And Soil Erosion.
		10. Marine Life.
	(7)	11. Sediments And Past Climates
		12. Effects Of Winds And Currents On Fisheries.
11	11	C. Climate, Agriculture, And Food.
		1. Introduction.
		2. Climatic Factors In Crop Production
		3. Temperature And Crops
		4. Phenology.
		5. Frost.
		6. Frost Prevention.
		7. The Frost-Free Season.
		8. The Moisture Factor.
		9. Drought.
		10. Combating Drought-Irrigation.
		11. Crops And Wind.
		12. Climatic Factors In Animal Husbandry.
		13. Insects And Diseases.
		14. Selection And Breeding for Climatic Adaptation.
		15. Plant And Animal Introduction.

16. Aquaculture.

12	12	D. Climate, Energy, And Industrial Technology. 1. Introduction. 2. Climatic Factors In Energy Management. 3. Design And Construction. 4. Aviation. 5. Weather In Flight. 6. Turbulence. 7. Aircraft Icing. 8. Water Transport. 9. Railways And Highways. 10. Manufacturing.
	(8)	11. Products Of Energy Consumption: Atmospheric Pollution.
13	13	E. Human Bioclimatology 1. Introduction. 2. Heat Budget Of The Body.

Class #	Lecture # (Discussion Topic #)	Topic
		3. Cooling Power. 4. Clothing And Climate. 5. Indoor Comfort. 6. Weather And Health. 7. Sunshine And Health.
	(9)	8. The Ozone Layer. 9. Climates And Disease. 10. Acclimatation. 11. Perception Of Climate And Climate Hazards.
		F. Climate And Housing. 1. Introduction. 2. Climate Aspects Of Site. 3. Climate Conditioning. 4. Building Orientation. 5. Climate Conditioning Through Design. 6. Air Conditioning. 7. Heating. 8. Cooling.

TEST 3

14	14	IV. Climate Modification, Past Climates, And Climate Forecasting. A. Climate Modification. 1. Introduction

2. Modifying Microclimates.
(10) 3. City Climates.
4. Inadvertent Modification Of Macroclimates.
5. Planned Modification.
(11) 6. Cloud Modification And Implications.
7. Fog Dispersal.

B. Past Climates.
1. Introduction
2. Proxy Evidence And Geochronology
15 15 3. The Earth's Climatic History
(12) 4. Theories Of Climatic Change And Ice Ages.

C. Forecasting Climate.
1. 1-Dimensional Radiative-Convective Models
2. 3-Dimensional General Circulation Models
3. 2-Dimensional General Circulation Models

FINAL EXAM

14. LAB SCHEDULE:

Week	
1	Some Preliminaries.
2	Solar Radiation.
3	The Seasons.
4	Basic Climate Statistics.
5	Other Types Of Means.
6	Variability Of Temperature, Precipitation, And Wind Speed.
7	Cumulative Frequency Distributions And Wind Roses.
8	Climatic Variability And Classification.
9	Tropical Humid, Subtropical, And Temperature Climates.
10	Boreal, Polar, And Semi-Arid Climates.
11	The Greenhouse Effect And The Runaway Greenhouse Effect.
12	Microclimates Of Cities.
13	Climates – Past, Present, And Future.
14	Forecasting Difference Schemes.

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