Earth Science 1110
Introduction to Meteorology
Professor Paul L. Sirvatka or Ron D. Stenz
College of DuPage
5 Contact hours; 4 Credit Hours (3 lecture, 2 lab)

Description: A first look at various aspects of meteorology, including solar radiation, global circulation, environmental issues, winds, stability, precipitation processes, weather systems, and severe weather. Basic physical principles, meteorological terminology, societal impacts, and weather analysis will be explored.

Prerequisite: MATH-0465 or MATH-0481 (or college equivalent) with a grade of C or better or qualifying score on the mathematics placement test or a qualifying A.C.T. math score. Course requires Reading Placement Test Score-Category One.

Phone/Office: Lab: (630) 942-2590 BIC 3501
E-mail: sirvatka@cod.edu or stenzr@cod.edu
Homepage: http://weather.cod.edu/
Class page: http://bb.cod.edu

Office Hours: _____ I will also be available at other times. Please try to set up an appointment if you wish to see me at any time. Please feel free to contact me with questions using email as well.

Text: Weather – A Concise Introduction, Gregory Hakim and Jerome Patoux, Cambridge University Press, 2017. ISBN: 9781108404655

Please bring your textbook to class. You may be given book assignments, including quizzes based upon your reading. I would like you to outline the reading material to help guide the reading. You will be allowed to use those outlines on those reading quizzes. If you have done a decent job of outlining, you will have a very easy time with those quizzes. This is the best opportunity that doing the required work will assist your grade.

Additional Materials: #2 pencils for tests and good colored pencils (at least red, blue, yellow and green) are required daily. Calculators are not allowed on tests or quizzes but may be used during class and you are encouraged to bring one. A three-ring notebook is also required to assist in maintaining sufficient organization.

Attendance: Attendance is extremely important. Much of the material is covered only in class. It is expected that you will attend all classes. Contact the instructor as soon as possible in the event of an unavoidable absence. Labs and quizzes cannot be made up. Only in exceptional circumstances can tests be given at a time other

than the announced date. Exceptions must be pre-arranged. A missed test is a zero.

Grading:

Labs, quizzes and homework assignments	~ 30%
Unit exams	~ 45%
Cumulative final exam	~ 25%

Grades will be curved based upon expected results and class participation and attitude. Generally speaking, the grades will be as follows:

A – 84%; B – 73%; C – 62%; D – 50%; F < 50%

All work must be completed. An incomplete will be given only in an exceptional circumstance. It is the student's responsibility to withdraw from the course due to non-attendance. This must be done by _____. Failure to withdraw by that date will result in an "F". Late assignments will be penalized to a maximum credit of 50% at the discretion of the instructor. Students wishing to take this course on a pass/fail basis must earn a grade of a "C" or higher to receive a "Satisfactory" for the course. In order to fulfill the general education requirements a letter grade must be received.

Course Objectives: Upon successful completion of this course the student should be able to do the following:

1. Define layers and constituents of the atmosphere
2. Summarize basic laws of physics and thermodynamics
3. Describe various moisture parameters
4. Classify cloud genre and describe cloud and precipitation formation
5. Explain thunderstorm formation and stability analysis
6. Summarize radiation laws and their applications
7. Discuss earth-sun relationships and their influence on weather and climate
8. Differentiate between global warming and the greenhouse effect
9. Interpret and summarize physical models for describing winds, including geostrophic, gradient, and surface flow
10. Classify types of fronts and air masses
11. Form generalizations about extra-tropical cyclone formation and evolution including sensible weather resulting from their attendant fronts
12. Define severe thunderstorms and tropical storms and plan safety responses to various weather hazards

Expectations: The student is expected to attend all classes, participate fully in classroom discussions and cooperate in learning experiences with other classmates. The

expected workload is two hours of work for every hour of time spent in class. This will vary from week to week with some weeks having more work required and other weeks having less.

Extra Credit: There may be an instance or two of opportunities to make up for a missed class by participating in a forecasting discussion or attending an AMS presentation.

Final Exam: A cumulative final exam will be given. Check MyAccess at https://myaccess.cod.edu/ for a listing of the final schedule.

Advising: Please feel free to speak to me concerning school plans and classes to take, whether or not you are involved in meteorology as a major. I will be more than happy to discuss anything related to school or anything else in your life that might be a problem or obstacle to your success. This course is participating in the Early Alert system. If your progress in this course falls below course expectations, you may be referred to a counselor to discuss how you can improve your performance. If you are contacted, please make an appointment immediately.

Topical Outline and Reading Assignments

Text: Weather – A Concise Introduction, Gregory Hakim and Jerome Patoux

Please bring your textbook to class every day. Worth 25 points a unit, I want each student to do a thorough outline of the reading assignment. Follow the list of helpful tips below.

- Make sure to include the **most important** points
- Do not write down facts that are too simple and unneeded for studying at a later point. Include the points that will help you understand the chapter better.
- **Include diagrams**. In the text book, diagrams are sometimes the most important part of the chapter.
- Each unit should take between 3 and 5 hours, depending on the length of the reading material. Doing less probably means you have not included enough material. Taking too much time might mean you are doing too much.
- You do not have to do the outline perfectly. This is meant to give you a strong foundation in the material and provide you with additional study material.
- Show me that you have done the studying, and your grade will be strong. Prove to me your effort.
- Improve them as the unit goes on. There is no reason they cannot be improved.

These outlines are very important because the tests are difficult. A C-student on the tests can still get a B because of these outlines. Unfortunately, some students get a lower grade because they have not done a good job on these outlines. For an additional resource in doing a good outline, see http://www.wikihow.com/Do-a-Chapter-Outline.

Unit 1 - Chapters 1, 2, 3, Chapter 4 pages 51-53, Chapter 6 pages 92-94

Week One

- INTRODUCTION
- P=ρRT: FUNDAMENTAL BEHAVIOR OF THE AIR

  Charles' Law; Boyle's Law; The Ideal Gas Law; Adiabatic Processes

Week Two

Lab 1 - Meteorological Mathematical Concepts Lab (3 hours)

Introduction to math concepts needed for physical scientists. Students will do hand-on calculations of problems associated with meteorological objectives and learn to anticipate questions needed for further investigation into meteorological concepts.

- HEAT AND TEMPERATURE
- ADIABATIC PROCESSES

  Lapse Rates

Week Three

- STRUCTURE OF THE ATMOSPHERE

  Layers; Chemical Constituents; Importance of Gases; Meteors

Lab 2 - Geography Lab (3 hours)

Students will access various sources of information and identify important geographical features and regions that affect weather forecasting. Students will also investigate National weather Service Products to understand how information is disseminated across the US.

- WEATHER INSTRUMENTS

- STATION MODELS

  Symbols and Meanings

- ENVIRONMENTAL ISSUES AND CONCERNS

  The Greenhouse Effect; Global Warming; The Ozone Problem

Test I

Geography Quiz

Unit 2 – **Chapters 5, 6, 7, Chapter 11 pages 188-190**

Week Four

- WATER IN THE ATMOSPHERE

  Relative Humidity; Mixing Ratio; Dew Point; Wet Bulb; Vapor Pressure

Lab 3 – Water Vapor Parameters (3 hours)

Using tools that measure vapor content, students will examine various parameters that are used to describe water vapor content.

- WATER ON THE EARTH

  Floods; Fog; Steam

Week Five

- CLOUDS

  Types; Collision and Coalescence; The Bergeron Process

- STABILITY AND INSTABILITY

  Parcel Method; Judging the Atmosphere's Stability; LCL; LFC; EL

Lab 4 - Instability Lab (4 hours)

Plotting soundings of temperature with height, students will explore relationships to temperature to instability parameters and determine sensible weather conditions.

Week Six

- LIFE CYCLE OF A GARDEN VARIETY THUNDERSTORM

  Development; Frozen Precipitation

Test II

Unit 3 - Chapter 4, 14, 15

Week Seven

Lab 5 – Radiation Lab - Math Lab Part 2 (3 hours)

A deeper investigation into math concepts needed for understanding equations governing electromagnetic radiation. Students will do hand-on calculations of problems associated with Blackbody radiation and use scientific notation.

- ELECTROMAGNETIC RADIATION

  $c = \lambda \cdot f$; Electromagnetic Spectrum
- THE SUN

  Physical Properties; Temperature

Week Eight

- BLACKBODY RADIATION

  Wien's Displacement Law; Stefan-Boltzmann Law

- VARIABILITY OF INCOMING SOLAR RADIATION

  Seasons; Orbit; Temperature vs. Length of Day

Lab 6 - Climate Lab (2 hours)

Students will calculate various commonly used parameters for understanding climate statistics. Using actual data, students will evaluate how the weather compares to the climatology.

Week Nine

- RADIATION AND THE EARTH-ATMOSPHERE SYSTEM

  Absorption; Reflectivity; Scattering;

- ENERGY BUDGET

  Radiation, Conduction and Convection

Lab 7 – **Earth Sun Relationships Lab** (**2 hours**)

Students will be expected to explore various earth sun relationships to understand the meridional variation of heating and hence the seasons.

Week Ten

- GENERAL CIRCULATION

  Hadley Cell; Three-Cell Model; ITCZ

Test III

Unit 4 – **Chapters 8, 9, 10, Chapter 11 pages 190** – **200, Chapter 12**

Week Eleven

- FORCES OF MOTION

  Gravity, PGF, Coriolis Force, Centrifugal Force, Friction

- FORCES AND WINDS - DEVELOPING AN UNDERSTANDING OF THE JET STREAM

  Geostrophic; Gradient; Surface; Hydrostatic Equation

Lab 8 – **Physics Lab** (**4 hours**)

Students will solve problems with falling objects as object accelerate due to gravity. Students will then apply objectives into understanding traditional problems associated with falling objects which include experiments to demonstrate Newtonian principles.

Week Twelve

- SEA AND LAND BREEZES

  Time and Size Scales; Mesoscale Circulations

Lab 9 - Wind Speed Determinations (3 hours)

Students will calculate geostrophic and gradient wind problems using actual weather maps.

Week Thirteen

- AIR MASSES AND FRONTS

  Identification and Modification; Finding Fronts; Types; Cross-Sections; Associated Weather

Lab 10 - Cyclone and Isoplething Lab (3 hours)

Using traditional weather lab methods, students will complete isoplething assignments.

Week Fourteen

- LIFE CYCLE OF A WAVE CYCLONE

  Baroclinity; Cyclogenesis; Frontogenesis; Associated Weather

- THUNDERSTORMS AND SEVERE WEATHER

  Squalls; Convective Instability; Multicell and Supercell Storms

Week Fifteen

- SURVIVING AND UNDERSTANDING SEVERE WEATHER

  Lightning; Tornadoes; Safety

- HURRICANES AND TROPICAL STORMS

  Formation; Safety; Conservation of Angular Momentum

Test IV

Final Exam