Earth Science 1115
Severe and Unusual Weather
Professor Paul L. Sirvatka or Ron D. Stenz
College of DuPage
5 Contact hours; 4 Credit Hours (3 lecture, 2 lab)

Description: In depth study of meteorological phenomena relating to severe thunderstorms, El Niño/Southern Oscillation events, and tropical storms. Topics will include severe weather spotting, weather radar, atmospheric soundings, tornadogenesis, El Niño, tropical meteorology, hurricanes, and an introduction to numerical weather prediction. Basic physical principles, their relation to weather events, and weather's impact on society will also 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.

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Class Notes: 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: Severe and Hazardous Weather, Rauber, Walsh and Charlevoix, Fifth Edition, Kendall/Hunt, 2012. ISBN# 978-1-5249-3166-7.
Labs are created by instructor and will be given during various times of the term. The time spent on laboratory work will average 2 hours per week. Partnerships will be assigned as needed. Additional background material will be available on meted.ucar.edu.

Additional Materials: #2 pencils for tests and good colored pencils (at least red, blue, yellow and green) are required *daily*. Calculators may be used during class and you are encouraged to bring one with the sine (sin) function on it. A three-ring binder is also **required** to assist in maintaining sufficient organization. Print out notes that are available at http://weather.cod.edu/notes/

Attendance: Attendance is extremely important. Much of the material is covered only in class. It is expected that you will attend all classes. Assignments will be checked frequently. 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.

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

Grading:

Labs/Lab Exams	~ 25%
Quizzes and homework assignments	~ 15%
Unit exams	~ 60%

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

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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". Excessive withdrawals may negatively impact your eligibility for financial aid. Please consult with an adviser for more information.

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. Determine the kinematic flow fields within a thunderstorm
2. Judge the strengths and weaknesses of weather radar
3. Recognize radar patterns indicating a potential for severe weather occurrence
4. Demonstrate proficiency in visual identification of thunderstorm features
5. Identify environments conducive to severe weather formation
6. Plot and interpret an atmospheric sounding on a Stüve diagram
7. Describe the significance of water vapor in thunderstorm development and differentiate between various moisture parameters
8. Summarize indices used in severe weather forecasting
9. Diagnose synoptic-scale conditions favorable for severe weather development
10. Plot and interpret a hodograph
11. Explain the source of rotation in a supercell thunderstorm
12. Summarize the canonical cycle of an El Niño/Southern Oscillation and summarize its effects on global weather patterns
13. Describe the circulation in the tropical atmosphere
14. Explain the evolution of a tropical storm system
15. Compare the atmosphere to a Carnot heat engine
16. Explain the energy cascade
17. Express the basics of numerical weather prediction
18. Explain the role of chaos theory and unpredictability in numerical weather prediction

Expectations: The student is expected to attend all classes, participate fully in classroom discussions and cooperate in learning experiences with other classmates. Excessive absenteeism will result in a drop in your grade by at least one letter. 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.

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: Severe and Hazardous Weather, Rauber, Walsh and Charlevoix, Fifth Edition

Please bring your textbook to class everyday. Worth ten points a piece, I want each student to do a thorough outline of each chapter. Follow the list of helpul 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 chapter should take between 90 and 180 minutes, depending on the length of the chapter. 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 I Thunderstorms Morphology and Radar Meteorology – Chapter 1, 2, 3, 18, 19

A. Structure and kinematics of a thunderstorm - Week 1,2
   a. Kinematic flow-fields lab Course Objective 1

B. Thunderstorm classification - Week 2

C. Radar meteorology – Week 3,4
   a. History
   b. Physics of radar in meteorological applications
   c. Description of radar products and their uses
   d. Shortcomings and limitations of weather radar CO2
   e. Radar interpretation lab CO3

D. Thunderstorm visualization and spotter's training CO4 Week 5,6
   a. Understanding convective hazards
   b. Storm classification
   c. Thunderstorm visuals identification lab

E. Thunderstorm evolution and morphology Week 7
   a. The Lemon Technique
   b. Radar-based warning decisions
   c. Simulation of the warning process lab

<u>Unit II</u> Thermodynamics – The Workings of Storms – Chapter 6

F. Thermodynamics [CO5] Week 8, 9, 10
    a. Air parcels and environmental soundings
    b. Water vapor's role in thunderstorm development [CO7]
    c. Static and convective instability
    d. The thermodynamic diagram use in severe weather meteorology [CO6]
    e. Thermodynamic diagram lab - part 1
    f. Thermodynamic diagram lab - part 2 [CO8]

G. The planetary boundary layer Week 11
    a. Mechanically-induced and thermally-induced turbulent eddies
    b. Elevated mixed layers and dry line formation

<u>Unit III</u> Synoptics – Putting It All Together – Chapter 7, 8, 9, 10

H. Synoptics and thunderstorm initiation [CO9] Week 12
    a. Fronts air masses and the jet stream
    b. Development of wind
    c. Long and short waves

I. Vertical wind shear Week 12,13
    a. Development of storm-scale rotation [CO11]
    b. Understanding hodographs [CO10]
    c. Unidirectional and curved shear
    d. Tornadogenesis
    e. Hodograph Lab

<u>Unit IV</u> El Niño, Hurricanes and Tropical Meteorology – Chapters 23, 24, 4

J. Tropical Meteorology Week 14
    a. El Niño, the Southern Oscillation, and La Niña [CO12]
    b. The tropical atmosphere [CO13]

K. Tropical storms and hurricanes Week 15
    a. Tropical storm development [CO14]
    b. Developing a general theory of hurricanes
    c. Hurricane structure
    d. Atmospheric circulations in terms of energetics [CO15,16]
    e. Hurricane Energy Lab

L. Numerical models and weather prediction [CO17] Week 15
    a. Introduction to numerical weather prediction
    b. The role of chaos in a dynamic environment [CO18]
    c. The unpredictability of weather and The Butterfly Effect
    d. Strengths and shortcomings of numerical weather prediction