ATS 570: Mathematical Methods in the Atmospheric Sciences

Instructor:	Dr. Jon M. Schrage
Office Hours:	Monday through Thursday: 3:30-4:15, Tuesday and Thursday: 9:30-10:30, or by appointment
Email:	schragej@gmail.com
Phone:	280-5759

Text:	None required.
Prereq:	MTH 246: Calculus II

Grading:

Midterms (3)	45%
Final (cumulative)	15%
Homework	40%

Grading Distribution:

90-100%	A
88-90%	B+
80-88%	B
78-80%	C+
70-78%	C
60-70%	D
0-60%	F

In reality, I have no preconceived notions about what the grade distribution for the course will be. In all likelihood, the grades may be "scaled".

The last day for registration and schedule changes is January __. This is the last day you can drop the course without getting a "W". You can also add courses until this date. The last day for students to withdraw without a "WF" is March 21.

Course Description and Goals:

The purpose of this course is to summarize the mathematical and statistical tools that will be necessary for successful completion of the ATS 571-572 sequence. Additionally, the course is designed to make students more prepared for success in their graduate education. Special attention is paid to applications of various mathematical methods to specific problems encountered within the atmospheric sciences. Goals for the course include but are not limited to the following:

1. Students will be able solve, interpret and visualize common mathematical representations of processes within the atmosphere, including multidimensional fields of scalars and vectors.
2. Students will be able to use selected skills from calculus and differential equations topics that are commonly utilized in the atmospheric sciences in general and the Atmospheric Dynamics course sequence in particular.
3. Students will be able to solve problems of circulation and fluid dynamics using the notation and methods of vector calculus.

Basic Classroom and Attendance Policies:

- Feel free to contact me whenever you have questions or comments, either by email or by phone.
- Almost any excuse for missing a class will work *if you let me know in advance*. If you miss a lecture *without prior notification*, bring some form of documentation (e.g., a note from the doctor, a police report, etc.).
- Arrive for class on time.
- *All incidents of academic dishonesty on exams will be prosecuted to the full extent of university policy.* The definition of "academic dishonesty" can be found in the Creighton University Bulletin. Here's a good rule of thumb: if it seems like you are getting credit for work you didn't do, it's probably academic dishonesty. This is not meant to discourage students from studying together, exchanging notes, or working together on homework assignments. For more information, I refer you to http://puffin.creighton.edu/ccas/policies/acadhonesty.html.
- Excessive absences can lead to an automatic failure of the course. Automatic failure proceedings generally will begin once a student has missed 6 classes.
- Occasionally it is necessary to cancel lecture due to scheduling conflicts with conferences and meetings. Such "scheduled" cancellations will be addressed by providing the students will materials—including readings and/or videos and activities on CD—that cover the topics for that day.
- If class is cancelled unexpectedly, I will send email to the class and contact the departmental Administrative Assistant. No other posting or announcement of class cancellation should be considered official.

Course Outline and Key Topics:

Unit I: Numerical Depictions of the Atmospheric State

Coordinate systems; scalar and vector representations; vector operators and identities; matrices; gradients and advection; relative vorticity and “curl”; divergence; Helmholtz’s Theorem

Unit II: Applications of Calculus

Total (lagrangian) and partial (eulerian) derivatives; finite difference approximations; second derivatives—accelerations; second derivatives—laplacian operators; velocity potential and streamfunction; multiple integrals; summation notation

Unit III: Applications of Vector Calculus

Vector fields; line integrals; surface integrals; the Divergence Theorem; Green’s Theorem; Stokes’ Theorem; the Circulation Theorem

Unit IV: Mathematical Statistics in the Atmospheric Sciences

Estimation of parameters; distributions; hypothesis testing and confidence intervals; regression, multiple regression and autocorrelation; convolutions of functions; filtering

In the event of disruption of normal classroom activities due to a disease or other medical outbreak, a natural disaster, or other emergency, the format for this course may be modified to enable completion of the course. In that event, you will be provided an addendum to this syllabus that will supersede this version.