



SYLLABUS

ATMS 305 : Computing & Data Analysis

Spring Term 2010

Room G8A Foreign Languages Bldg, 5:00 pm – 6:15 pm T R

Instructor

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Office Hours: M 2:00 pm – 3:00 pm, W 10:00 am – 11:00 am

Required Text

Essential Matlab For Engineers and Scientists, by Brian D. Hahn & Daniel T. Valentine,
Butterworth-Heinemann Publishers, 4th Edition

The book's website <http://www.scitechpub.com/Hahn.htm> has links to additional electronic materials including solutions to selected problems.

Purpose

ATMS 305 is a comprehensive introduction to atmospheric and geophysical data. In this course you will learn how to visualize and analyze data using cutting-edge software tools. After completing this course, you will be able to solve real-world scientific problems that you may encounter in your job or research.



This course will follow 2 parallel tracks. The first track will be very mathematical where you will learn statistical and spectral methods of analyzing data. In the second track, you will learn how to program with MATLAB and Google Earth. These two tracks will be bridged by the homeworks where you will use mathematical and programming tools to examine atmospheric and geophysical data available in the public domain.

The mathematical and quantitative skills acquired in this course will help you become a better scientist. Your MATLAB and Google Earth programming skills may also open up a possible career in the IT industry, if you chose to do so.

Content

1. MATLAB:

- Fundamentals: launch and exit MATLAB, data I/O, arrays, loops, if-blocks, debugging
- Advanced tools required for data visualizations and analysis

2. Google Earth:

- Fundamentals, launch and exit, writing kml files, data I/O, plotting, printing maps

3. Data visualization:

- Work with data in several popular formats including ASCII, simple binary and Excel.
- Display data in 1, 2 and 3 dimensions, create line plots, contour maps, surface plots.
- Data interpolation/extrapolation

4. Univariate and bivariate statistics:

- Statistical description of data: central tendency, dispersion, shape.
- Introduction to probability distributions, hypothesis testing, statistical significance, common statistical tests, selecting appropriate tests
- Correlation coefficient, bootstrapping
- Modeling, linear and non-linear regression, goodness of fit, confidence intervals

5. Spectral analysis/ signal processing:

- Time series, trend, periodicity, time vs frequency domain, spectral analysis with FFT
- Applications of spectral techniques: digital filtering, data compression, removing noise from audio recordings, compressing music files

Course Web Page

We will be using the *Compass* web environment to facilitate communication between you, your classmates, your TA and myself. On the web site I will post the lecture note outlines, examples,



homework, solutions to the homework, quizzes, relevant web links, and other information. The course web site can be found at: <http://compass.uiuc.edu/>.

Evaluation

The final grade will consist of:

Homework	5 x 15%	75%
Quizzes	5 x 5%	25%

Please note that the grading will be **absolute**, not on a curve. Total points will be converted to a letter grade based on the following chart:

Points	<67	67-69	70-72	72-75	76-78	79-81	82-84	85-87	88-90	91-93	94-96	96-98	98<
Grade	F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A	A+

Homework

There will be five (5) homework assignments involving reasoning and quantitative problem solving. Homeworks will be collected at the **beginning** of the class period on the stipulated date. Late submissions will be penalized according to the following guideline:

- 20% deduction if you submit by the end of the class
- 50% deduction if you submit before the beginning of the next class
- No credit thereafter.

Quizzes

There will be many quizzes throughout the semester. Quizzes may not be announced ahead of time. Only the best five (5) will be considered.

There are **no make-up quizzes**. Quizzes missed *for any reason* will simply count among those dropped.

Policy on Appealing Homework and Quiz Grades

If you feel that an assessment has been graded incorrectly, return it to me **within one week** of when the grade was given. On an attached sheet state the number of the problem, and give a brief, coherent explanation of why your answer is either correct or deserves more points.



Excused absence

Regular attendance is expected. I will arrange a make-up for a missed quiz or extend a homework deadline only if **all 3** of the following conditions are met:

1. your absence is due to causes specified in the Student Code Article 1 Part 5: 1-501 and 1-502;
2. you submit a written explanation for your absence along with appropriate documentation, e.g., medical report, etc. **within one week** of returning to class; and
3. you notify the Emergency Dean regarding your absence and request the Dean to forward this information to me via e-mail or campus mail.

Tentative Course Schedule Overview

This schedule gives an overview of the topics we will cover in the course. On the first day of class after Spring break you will be given the schedule for the next part of the course.

Class #	Topic	
01	Introduction to MATLAB (Ch 1)	
02	MATLAB Fundamentals 1 (Ch 1,2)	
03	MATLAB Fundamentals 2 (Ch 2, 6)	
04	MATLAB Fundamentals 3 (Ch 2, 8)	
05	MATLAB Fundamentals 4 (Ch 2, 7)	
06	Structure plan (Ch 3)	HW1 given
07	HW1 workshop	
08	Data I/O (Ch 4)	HW1 due
09	Data I/O (Ch 4)	
10	Data I/O (Ch 4)	
11	Logical vectors, Matrices (Ch 5, 6)	HW2 given
12	HW2 workshop	
13	User-defined Functions (Ch 10)	HW2 due
14	Univariate Statistics	
15	Probability Distributions	
16	Statistical Tests	
17	Bivariate Statistics	
18	Regression	HW3 given