Earth Sciences 2222B Data Analysis and Signal Processing in the Sciences
Jan.-April, 2014

Lecturers: Prof. Rick Secco
Dr. Hadi Ghofrani

(Course Material courtesy Prof. Gail Atkinson, Dr. Hadi Ghofrani)
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Description: An introduction to data analysis techniques, including data types and analysis tools, statistical methods to characterize univariate, bivariate and multi-variate data, time series and signal processing. A variety of applications from various fields will be used to illustrate these techniques, with emphasis on applications in the earth sciences.

Antirequisite(s): The former Earth Sciences 322a/b.
Prerequisite(s): 0.5 course from Calculus 1000A/B, 1100A/B, 1500A/B or Mathematics 1225A/B; or Applied Mathematics 1413.

2 lecture hours, 3 laboratory hours, 0.5 course.

Lectures: Mondays & Wednesdays 10:30 – 11:30 am B&GS-0153
Lab: Wed. 2:30 – 5:30 pm B&GS-0184

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

This course involves programming with MATLAB and COPLOT. Some start-up instruction in the use of MATLAB and COPLOT will be given.

TUTORIAL HELP: Ample time will be built into every lecture period for answering questions, in addition to the lab time, which is focused on answering questions and working on assignments. The lab period is the course tutorial.

METHOD OF ASSIGNING FINAL GRADE: There will be 5 take home/lab Assignments, 2 Term Tests, and a group project (oral and written presentation). All assignments are due on the third lecture after the assignment is given.

Term Test I: end of Feb
Term Test II: end of March
Project Presentations: TBA (likely first week of April)

The ability to express ideas in a coherent and logical manner is an important factor in evaluation of assignments, tests.

Final Grade: Assignments --- 50% Project --- 15% Term tests--- 25% Participation ---10%

TEXTBOOK

MATLAB Recipes for Earth Sciences (2nd edition, 2007 or 3rd edition, 2010) – Martin Trauth. Springer.

Additional References
The following texts are recommended for additional reading and supplement to the lectures, but not required:
Data Reduction and Error Analysis for the Physical Sciences – Philip R. Bevington (and D. Keith Robinson.). A classic text, well written, clear, and not too much math.
Time Series Analysis: A comprehensive introduction for the Social Scientists. J. M. Gottman Camb.U. Press, 1984. A very good introductory text aimed at social sciences, but with insights for all fields.

Long Description of content:

Week 1 – Introduction (Jan. 6)
Purpose and scope of course
Course expectations and evaluation
Overview of data types
Overview of data analysis tools and methods

Week 2/3 – Data Analysis Tools (Jan. 13, 20)
Programming with MATLAB
MATLAB basics
Syntax
Data input/output
Scripts/functions
Plotting in MATLAB

Week 4 – Univariate Statistical Problems and Distributions (Jan. 27)
Empirical distributions
Theoretical distributions
Distribution tests

Week 5 – Bivariate/Multivariate Problems (Feb. 3)
Trends and Correlations
Regression Analysis
Residual Analysis

Week 6 – Review (Feb. 10)

Reading Week (Feb. 17)

Week 7 – COPLOT for Graphically-Based Statistical Analysis/Regression (Feb. 24)
Quiz 1 (Feb.27)

Week 8 – Time Series Analysis (March 3)
Generating and analyzing time series data

Week 9 – Signal Processing (March 10)

Week 10 – Spatial Data and Mapping (March 17)

Week 11 – Review and Quiz 2 (March 24)

Week 12 – Class Projects (Apr. 1)

Due Dates:

- **Assignment 1 (4%)** – Jan. 30
- **Assignment 2 (20%)** – Feb. 13
- **Quiz 1 (10%)** – Feb. 27 (class time)
- **Assignment 3** (8%) – March 4
- **Assignment 4** (20%) – March 18
- **Assignment 5** (8%) – March 25
- **Quiz 2** (15%) – March 27 (class time)
- **Draft project oral progress reports** – April 1 (class time)
- **Project oral presentations** (5%) – April 3
- **Project written report** (10%) – April 8

Policy Statements:
Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see:
http://www.uwo.ca/univsec/handbook/appeals/medical.pdf

A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here:
https://studentservices.uwo.ca/secure/medical_document.pdf

Accessibility Statement: Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.